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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

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W84-00701 -- W84-01050

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management ond Budget through September 30, 1985.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientitsts, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey, MS 421
Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

A HYDROLOGIC ANALYSIS OF THE NEW JERSEY PINE BARRENS REGION,
E. C. Rhodehamel.
Water Resources Circular No 22, New Jersey Department of Environmental Protection, (Trenton), 1970. 35 p, 2 Fig, 2 Tab, 33 Ref.

Descriptors: *Hydrologic budget, *Precipitation, *Evapotranspiration, *Interception, *Groundwater, *Water yield, *Water quality, *Surface water, *Water supply, Water resources development, Forest hydrology, Base runoff, Groundwater runoff, Chemical properties, Ground water reservoirs, Drilling, Coastal plains.

Water is one of the principal resources of the Pine Barrens region of New Jersey. This report discusses the region's hydrology and assigns values to many of the important hydrologic parameters. The long-term hydrologic budget in the region can be stated as P = R + ET, where P, the average annual precipitation, is 45 inches; R, the average annual stream runoff, is 22.5 inches; and ET, the average annual evapotranspiration, is 22.5 inches. Average annual evapotranspiration losses of 2.41 bgd (billion gallons per day) can be divided into: (1) interception losses, 0.63 bgd; (2) evapotranspiration for undrained depressions, 0.09 bgd; and (3) evapotranspiration from soil and ground water, 1.69 bgd. Average annual stream runoff of 2.41 bgd can be divided into (1) direct runoff, 1.27 bgd; and (2) base runoff or ground-water runoff, 2.14 bgd. Flow of water within the regional flow system is calculated to be 70 million gallons per day. Because of low concentrations of total dissolved solids (25-50 milligrams per liter), treatment of the water for iron removal and pH adjustments will provide a water supply suitable for most purposes. Development of the water resources could be achieved by locating high-yielding wells adjacent to the downstream reaches of major streams, thus inducing streamflow to reenter the ground. The Pine Barrens region is in the central part of the Atlantic Coastal Plain, occupying about 2250 square miles of South-Central New Jersey. (Fazio-Omniplan)
W84-00781

USE OF A THREE-DIMENSIONAL MODEL FOR THE ANALYSIS OF THE GROUND-WATER FLOW SYSTEM IN PARKER VALLEY, ARIZONA AND CALIFORNIA,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-00823

HYDROLOGY OF COAL-RESOURCE AREAS IN THE SOUTHERN WASATCH PLATEAU, CENTRAL UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
T. W. Danielson, and D. A. Sylla.
USGS Water-Resources Investigations Report 82-4009, 1983. 66 p, 21 Fig, 16 Tab, 34 Ref.

Descriptors: Water resources management, Surface waters, Groundwater, *Water quality, Floods, Colorado River Basin, *Utah, *Coal mines, Hydrologic impacts, *Mine dewatering, *Hydrologic monitoring.

The study defines the surface and groundwater hydrology of coal-resources areas in the Southern Wasatch Plateau in Central Utah and, where possible, predicts the hydrologic impacts of underground mining. Discharge data at four streamflow gaging stations indicated that from 5 to 29% of the average annual precipitation on a drainage runs off streams, mainly during the snowmelt period (spring and summer). Most of the base flow of streams originates as spring discharge in the higher altitudes of drainages. Peak flows, average 7-day flood flows, and flood depths were related to basin characteristics in order to develop flood equations for ungaged sites. Chemical quality of surface water was suitable for most uses. Dissolved-solids concentrations ranged from 97 to 835 milligrams per liter in 61 samples collected throughout the area. Data from wells and coal-test holes, and a comprehensive spring inventory indicate that groundwater occurs in all geologic units exposed in the study area. The coal-bearing Blackhawk Formation and underlying Star Point Sandstone are saturated in most areas. Some future mining operations would require dewatering of the Star Point-Blackhawk aquifer. Most of the springs issue from the Flagstaff Limestone and North Horn Formation above the Star Point-Blackhawk aquifer. It is not known whether water in the Flagstaff and North Horn is perched. Dissolved-solids concentrations in groundwater ranged from 105 to 1,080 milligrams per liter in 87 analyzed samples. Water levels in wells, the discharge of springs, benthic invertebrates in streams, and quantity and quality of mine effluents all need to be monitored in order to detect changes in the hydrologic system caused by coal mining. (USGS)
W84-00893

A TWO-DIMENSIONAL FINITE-ELEMENT MODEL STUDY OF BACKWATER AND FLOW DISTRIBUTION AT THE I-10 CROSSING OF THE PEARL RIVER NEAR SLIDELL, LOUISIANA,
Geological Survey, Bay Saint Louis, MS. Water Resources Div.
J. K. Lee, D. C. Froelich, J. J. Gilbert, and G. J. Wiche.
USGS Water Resources Investigations Report 82-4119, 1983. 60 p, 16 Fig, 8 Sheet Maps, 10 Tab, 20 Ref.

Descriptors: *Finite element analysis, *Floods, *Flood plains, Flow around objects, Hydraulics, *Model studies, *Model assessment, *Louisiana, Mississippi, Model calibration, Pearl River.

A two-dimensional finite-element surface-water flow modeling system was used to study the effect of Interstate Highway 10 on water-surface elevations and flow distribution during the flood on the Pearl River on April 2, 1980, near Slidell, La. A finite-element network was designed to represent the topography and vegetative cover of the study reach. Hydrographic data collected for the 1980 flood were used to calibrate the flow model. The finite-element network was then modified to represent conditions prior to roadway construction, and the hydraulic impact of I-10 was determined by comparing 'before' and 'after' results. Upstream from the roadway, maximum backwater at the west edge of the flood plain (1.5 ft) is greater than maximum backwater at the east edge (1.1 ft). Backwater ranging from 0.6 to 0.2 ft. extends more than a mile downstream from the Pearl River bridge opening in I-10 at the east edge of the flood plain, and drawdown of 0.2 ft. or more occurs along approximately 2 miles of the west edge of the flood plain downstream from I-10. The capability of the modeling system to simulate the significant features of steady-state flow in a complicated multi-channel river-flood-plain system with variable topography and vegetative was successfully demonstrated in this study. (USGS)
W84-00896

GEOHYDROLOGIC RECONNAISSANCE OF LAKE MEAD NATIONAL RECREATION AREA--LAS VEGAS WASH TO OPAL MOUNTAIN, NEVADA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-00934

QUADRATIC SPLINE SUBROUTINE PACKAGE,
Geological Survey, Tacoma, WA. Water Resources Div.
L. A. Rasmussen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-155614, Price codes: A02 in paper copy, A01 in microfiche.
USGS Water Resources Investigations Report 82-41, 1982. 16 p, 2 Ref.

Descriptors: *Computer programs, Algorithms, Fortran, *Quadratic spline subroutine, *Curve fitting, Subroutines.

A continuous piecewise quadratic function with continuous first derivative is devised for approximating a single-valued, but unknown, function represented by a set of discrete points. The quadratic is proposed as a treatment intermediate between using the angular (but reliable, easily constructed and manipulated) piecewise linear function and using the smoother (but occasionally erratic) cubic spline. Neither iteration nor the solution of a system of simultaneous equations is necessary to determining the coefficients. Several properties of the quadratic function are given. A set of five short FORTRAN subroutines is provided for generating the coefficients (QSC), finding function value and derivatives (QSY), integrating (QSI), finding extrema (QSE), and computing arc length and the curvature-squared integral (QSK). (USGS)
W84-00993

MAGNITUDE AND FREQUENCY OF FLOODING ON SMALL URBAN WATERSHEDS IN THE TAMPA BAY AREA, WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. A. Lopez, and W. M. Woodham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-171884, Price codes: A04 in paper copy, A01 in microfiche.
USGS Water Resources Investigations 82-42, 1983. 52 p, 8 Fig, 16 Tab, 28 Ref.

Descriptors: *Urban runoff, *Flood frequency, *Regional flood, Hydrologic data, Land use, Rainfall intensity, Rainfall-runoff relations, Simulation, Urban watersheds, *Rainfall-runoff model, *Florida, Tampa Bay area.

Hydrologic data collected on nine small urban watersheds in the Tampa Bay area of west-central Florida and a method for estimating peak discharges in the study area are described. The watersheds have mixed land use and range in size from 0.34 to 3.45 square miles. Watershed soils, land use, and storm-drainage system data are described. Urban development ranged from a sparsely populated area with open-ditch storm sewers and 19% impervious area to a completely sewered watershed with 61% impervious cover. The U.S. Geological Survey natural-basin and urban-watershed models were calibrated for the nine watersheds using 5-minute interval rainfall data from the Tampa, Florida, National Weather Service rain gage to simulate annual peak discharge for the period 1906-52. A log-Pearson Type III frequency analysis of the simulated annual maximum discharge was used to determine the 2-, 5-, 10-, 25-, 50-, and 100-year flood discharges for each watershed. Flood discharges were related in a multiple-linear regression to drainage area, channel slope, detention storage area, and an urban-development factor determined by the extent of curb and gutter street drainage and storm-sewer system. The average standard error for the regional relations ranged from + or - 32 to + or - 42%. (USGS)
W84-00994

ANALYSIS AND COMPUTER SIMULATION OF STREAM-AQUIFER HYDROLOGY, ARKANSAS RIVER VALLEY, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
R. A. Barker, and L. E. Dunlap.
USGS Water Supply Paper 2200, 1983. 59 p, 54 Fig, 2 Tab, 29 Ref.

Descriptors: *Computer model, *Groundwater flow, Base flow, Recharge, Discharge, Withdrawals, Finite element digital model, *Arkansas River, *Kansas.

This study, made in cooperation with the Division of Water Resources, Kansas State Board of Agriculture, describes the geohydrology of the aquifer in the Arkansas River valley from the Colorado-Kansas State line to the Bear Creek Fault in south-

western Kansas. The Arkansas River meanders atop and interacts hydraulically with the sand and gravel aquifer. Average annual streamflow at Syracuse, Kansas, decreased from 173,000 acre-ft (acre-feet) during 1951-69 to 65,000 acre-ft during 1970-79. Water levels in the aquifer declined an average of 4 feet owing to decreasing recharge and increasing discharge during the 1970's. A digital-computer model, calibrated to simulate 1970-79 measured trends, indicated that annual recharge was 7,000 acre-ft less than the annual discharge of 81,000 acre-ft. Results showed that 1970-79 water-level declines and streamflow shortages were affected more by the departure from historic (1951-69) rate of incoming streamflow than by the reduced recharge or the increased pumpage. Water-level declines and streamflow reductions during 1980-82 could stabilize or reverse if monthly precipitation is 25 percent above-normal, pumpage is 50 percent of the 1979 rate, or incoming streamflow increases to the 1951-69 rate. (USGS)
W84-01016

GROUND WATER-SURFACE WATER RELATIONSHIPS IN THE BONAPARTE CREEK BASIN, OKANOGAN COUNTY, WASHINGTON 1979-80,
Geological Survey, Tacoma, WA. Water Resources Div.
F. A. Packard, S. S. Sumioka, and K. J. Whiteman.
USGS Open-File Report 82-172, 1983. 46 p, 18 Fig, 2 Tab, 7 Ref.

Descriptors: *Geohydrologic units, *Groundwater, Lakes, Observation wells, Recharge, *Surface-groundwater relationships, Water table, Bonaparte Creek, *Washington.

Ground water-surface-water relationships were studied in five morphological segments in the Bonaparte Creek basin, Washington during 1979 and 1980. In one segment, kettle lakes were found to be closely associated with the ground-water system. In the other four segments, a close relationship was found between streamflow and ground water. It was concluded that additional ground-water development would adversely affect lake levels and streamflow, thereby reducing surface-water resources already closed to further appropriation. The ground-water divide between the Bonaparte and Sanpoil basins was 6 miles southeast of where it was estimated to be. (USGS)
W84-01017

HYDROLOGIC ANALYSIS OF THE UPPER SAN PEDRO BASIN FROM THE MEXICO-UNITED STATES INTERNATIONAL BOUNDARY TO FAIRBANK, ARIZONA,
Geological Survey, Tucson, AZ. Water Resources Div.
G. W. Freethey.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $7.75 in paper copy, $3.50 in microfiche. USGS Open-File Report, 82-752, July 1982. 64 p, 19 Fig, 2 Tab, 25 Ref.

Descriptors: *Aquifer characteristics, *Groundwater availability, Groundwater basin, Specific capacity, Storage coefficient, *Computer model, Evapotranspiration, Effluent stream, Influent stream, *Model studies, Groundwater recharge, Artesian head, Hydraulic conductivity, Ephemeral streams, Perennial streams, Riparian plants, Specific yield, Transmissivity, Precipitation, Southwestern U.S., *Arizona, Upper San Pedro basin, Fort Huachuca, Basin fill, Finite-difference method.

A definition of the hydrologic system of the upper San Pedro basin was obtained by developing a numerical ground-water model to evaluate a conceptual model of the system. Information on hydraulic properties of the basin fill, recharge from bordering mountain ranges, discharge by evapotranspiration, and exchange of water between aquifer and stream was available from previous measurements or estimates. The steady-state calibration procedure and subsequent transient simulations demonstrated that the original conceptualization can be reasonably simulated. An analysis of model sensitivity to increases and decreases in certain hydraulic properties indicated a low sensitivity to aquifer anisotropy and a low to moderate sensitivity to stream leakance and evapotranspiration rate. An analysis to investigate the effects of generalizing aquifer conductivity and recharge showed that flow components and water-level response to stress could be simulated adequately but that steady-state water-level conditions could not. During equilibrium conditions, recharge to and discharge from the basin was about 16,500 acre-feet per year. Modeling results indicated that by 1978 the storage depletion rate had reached 5,600 acre-feet per year resulting from a ground-water withdrawal rate of 10,500 acre-feet per year. (USGS)
W84-01023

ANNUAL SNOWMELT AND RAINFALL PEAK-FLOW DATA ON SELECTED FOOTHILLS REGION STREAMS, SOUTH PLATTE RIVER ARKANSAS RIVER, AND COLORADO RIVER BASINS, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-01038

HYDROLOGY OF AREA 49, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, MONTANA AND WYOMING,
Geological Survey, Helena, MT. Water Resources Div.
S. E. Slagle.
USGS Water-Resources Investigations Open-File Report 82-682, January 1983. 94 p, 48 Fig, 15 Tab, 156 Ref.

Descriptors: *Groundwater, *Surface water, *Water quality, Coal, Coal mines, Strip mines, Spoil banks, *Montana, *Wyoming, Northern Great Plains, Powder River Basin, Fort Union Formation.

Area 49 encompasses about 10,700 square miles in southeastern Montana and north-central Wyoming and is drained by the Yellowstone River, the Tongue River, Rosebud Creek, and their tributaries. Streamflow varies seasonally, with the largest flows occurring in the spring in response to rainfall and snowmelt. During direct-runoff periods, the water generally is of the calcium magnesium bicarbonate type and can contain dissolved-solids concentration of less than 100 milligrams per liter. During low-flow periods, the water in streams generally is of the sodium sulfate type and can contain dissolved-solids concentrations in excess of 4,000 milligrams per liter. Principal water-yielding units are the Fox Hills-lower Hill Creek, Tullock, Tongue River-Wasatch, and alluvial aquifers. Wells in the Fox Hills-lower Hell Creek aquifer may yield as much as 200 gallons per minute. Wells in other bedrock aquifers commonly yield 8 to 15 gallons per minute. Yields to wells in alluvial aquifers commonly are 30 gallons per minute or less but may be several hundred gallons per minute along major streams. Water from aquifers less than about 200 feet deep generally is of the sodium sulfate type. Dissolved-solids concentration averages about 2,000 milligrams per liter. Water from deeper aquifers generally is of the sodium bicarbonate type and has an average dissolved-solids concentration of about 1,400 milligrams per liter. (USGS)
W84-01043

2B. Precipitation

HISTORIC AND PREHISTORIC PATTERNS OF WATER USE IN THE CONNECTICUT RIVER VALLEY: IMPLICATIONS FOR WATER RESOURCES PLANNING,
University of Northern Iowa, Cedar Falls. Dept. of Socialogy, Anthropology and Social Work.
For primary bibliographic entry see Field 6D.
W84-00968

2E. Streamflow and Runoff

FLOOD OF JUNE 13-15, 1981, IN THE BLANCHARD RIVER BASIN, NORTHWESTERN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00777

EVALUATION OF THE STREAM-FLOW DATA IN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W84-00809

FLOODS OF NOVEMBER 1978 TO MARCH 1979 IN ARIZONA AND WEST-CENTRAL NEW MEXICO,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00837

AN EVALUATION OF IDAHO STREAM-GAGING NETWORKS,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 7A.
W84-00866

CANE CREEK FLOOD-FLOW CHARACTERISTICS AT STATE ROUTE 30 NEAR SPENCER, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 4C.
W84-00871

FLOODS OF DECEMBER 1982 AND JANUARY 1983 IN CENTRAL AND SOUTHERN MISSISSIPPI RIVER BASIN,
Geological Survey, Atlanta, GA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00886

TIME OF TRAVEL OF SELECTED ARKANSAS STREAMS,
Geological Survey, Little Rock, AR. Water Resources Div.
T. E. Lamb.
USGS Water Resources Investigations Report-82-4048, 1983. 59 p, 36 Fig, 1 Tab, 7 Ref.

Descriptors: *Dispersion, *Flow rates, *Velocity, Discharge(water), Hydrographs, Low flow, Regulated flow, Surface waters, *Time-of-Travel, *Maximum concentration, *Arkansas, Streams.

Between 1971 and 1981, time-of-travel and dispersion measurements were made in 15 streams in Arkansas. Most of the streams studied were at or near base flow. Graphs are presented for predicting traveltime of solutes in segments of the streams studied. The relationship of time of passage and peak unit concentration to traveltime is presented for two of the streams. Examples of use and application of the data are given. (USGS)
W84-00895

MONTHLY LOW-FLOW CHARACTERISTICS OF GEORGIA STREAMS,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00923

TECHNIQUES FOR ESTIMATING FLOOD HYDROGRAPHS FOR UNGAGED URBAN WATERSHEDS,
Geological Survey, Doraville, GA. Water Resources Div.
V. A. Stricker, and V. B. Sauer.

USGS Open-File Report 82-365, April 1982. 24 p, 3 Fig, 5 Tab, 6 Ref.

Descriptors: *Floods, *Flood hydrographs, *Urban runoff, Runoff, Unit hydrographs, Design floods, Hydrographs, Storage, Detention reservoirs, Flood frequency, Urban drainage, *Clark method, *Peak discharge, Lagtime, *Design hydrographs, Flood volumes, Recurrence interval, Inundation, *Urban watersheds.

The Clark Method, modified slightly was used to develop a synthetic, dimensionless hydrograph which can be used to estimate flood hydrographs for ungaged urban watersheds. Application of the technique results in a typical (average) flood hydrograph for a given peak discharge. Input necessary to apply the technique is an estimate of basin lagtime and the recurrence interval peak discharge. Equations for this purpose were obtained from a recent nationwide study on flood frequency in urban watersheds. A regression equation was developed which relates flood volumes to drainage area size, basin lagtime, and peak discharge. This equation is useful where storage of floodwater may be a part of design of flood prevention. (USGS)
W84-00940

FLOODS OF OCTOBER 1977 IN SOUTHERN ARIZONA AND MARCH 1978 IN CENTRAL ARIZONA,
Geological Survey, Tucson, AZ. Water Resources Div.
B. N. Aldridge, and J. H. Eychaner.
Available from the USGS, OFSS, Federal Center, Lakewood, CO 80225, Price: $34.25 in paper copy, $6.50 in microfiche. USGS Open-File Report 82-687, July 1982. 167 p, 24 Fig, 13 Tab, 41 Ref.

Descriptors: *Floods, *Flood damage, *Hydrographs, *Peak discharges, *Regulated flow, *Reservoir storage, Discharge(Water), Frequency analysis, Historic floods, Precipitation(Atmospheric), Probability, Reservoir operation, Stream erosion, Streamflow, Surface runoff, Gila River, Maricopa County, Phoenix, Salt River, Santa Cruz River, Tucson flood history, Nogales, San Pedro River, Verde River, *Arizona.

As much as 14 inches of rain fell in southern Arizona and northern Mexico during October 6-9, 1977, and caused the highest discharge since 1892 in the Santa Cruz River at Tucson. The flood caused $15.2 million in damage along the Santa Cruz, San Pedro, and Gila Rivers. Widespread rainfall of 3 to 6 inches and 9 to 14 inches in places, during February 28 to March 3, 1978, caused the highest discharge since 1920 on the Salt River in Phoenix and resulted in three deaths. Statewide damage was $65.9 million, of which $37 million occurred in Maricopa County. Nine counties were declared disaster areas. Unusually high volumes of runoff and moderate peaks occurred on tributaries to the Salt and Verde Rivers upstream from reservoirs. Overflow from the Verde River reservoir system was the main cause of the flooding. Storage in the reservoirs reduced the peak discharge of the Salt River from a potential of about 260,000 ft super 3/s to 125,000 ft super 3/s and greatly reduced the duration of the flood. (USGS)
W84-00953

GRAPHICAL METHOD FOR ESTIMATING OCCURRENCE AND DURATION OF A CRITICAL LOW FLOW IN THE SACRAMENTO RIVER AT FREEPORT, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5G.
W84-00973

ESTIMATING PEAK DISCHARGES OF SMALL RURAL STREAMS IN MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
S. W. Wandle, Jr.
USGS Open-File Report 80-676, 1982. 33 p, 8 Fig, 8 Tab, 25 Ref.

Descriptors: Floods, *Design flood, *Peak discharge, *Regional analysis, *Frequency analysis, *Model studies, Regression analysis, Estimating equations, Natural-flow, Rainfall-runoff relationships, Surface runoff, *Massachusetts, Flood-frequency curves, Regionalization, Ungaged watersheds.

Floodflows on natural-flow streams in Massachusetts with drainage areas between 0.25 square miles and 260 square miles may be estimated from drainage area, main-channel slope, mean basin elevation, and the area of swamps, lakes, and ponds. Multiple-regression techniques were used to define the relationship between a suite of basin and climatic characteristics and flood peaks in three flood-frequency regions at a total of 95 sites. Station flood-frequency data were computed following guidelines in Bulletin 17A of the U.S. Water Resources Council. The frequency analyses are based upon weighted skew values, and adjustments for high and low outliers, and historic peak data. The regression equations for peak discharges with 0.5, 0.2, 0.1, 0.04, 0.02, and 0.01 exceedance probabilities provide the best estimate of peak flow at ungaged sites. An improved sample of flood peaks and gaging stations and the definition of three flood-frequency regions reduced the standard error of estimate by about 5% over those for the 1977 relations. Included in this analysis were the synthetic flood-frequency data at eight sites computed using historic climatic data and 10 parameters optimized by calibration U.S. Geological Survey's rainfall-runoff model with storm data observed over 11 years. (USGS)
W84-00990

CHANGES IN FLOOD RESPONSE OF THE RED RIVER OF THE NORTH BASIN, NORTH DAKOTA-MINNESOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 4C.
W84-01020

EVALUATION OF SELECTED ONE-DIMENSIONAL STREAM WATER QUALITY MODELS WITH FIELD DATA,
Geological Survey, Bay Saint Louis, MS. Water Resources Div.
For primary bibliographic entry see Field 5B.
W84-01027

SMALL-STREAM FLOOD INVESTIGATIONS IN MINNESOTA, OCTOBER 1958 TO SEPTEMBER 1980,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-01033

MEASUREMENT AND COMPUTATION OF STREAMFLOW: VOLUME 1. MEASUREMENT OF STAGE AND DISCHARGE,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W84-01048

MEASUREMENT AND COMPUTATION OF STREAMFLOW: VOLUME 2. COMPUTATION OF DISCHARGE,
Geological Survey, Menlo Park, CA. Water Resources Div.
S. E. Rantz.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $13.00 per set. USGS Water-Supply Paper 2175, 1982. 347 p, 165 Fig, 12 Tab, 82 Ref.

Descriptors: *Discharge(Water), *Discharge measurement, *Stage-discharge relations, *Water levels, Backwater, Current meters, Ice cover, Open-channel flow, Peak discharge, Pipe flow, Stream gages, Tidal streams, Water-level recorders, *Streamgage controls, Acoustic-velocity meters, Deflection meters, Discharge-rating shifts, Sand channels, Slope gaging stations, Tracer-dilution measurments.

This stream-gaging manual, in two volumes, describes the equipment and technical work involved in obtaining systematic records of streamflow. The subject is treated in accordance with six major topics. Volume 2, titled 'Computation of discharge,' covers computation of the stage-discharge relation, computation of daily-discharge records, and presentation and publication of stream-gaging data. In order to make the text as broadly usable as possible, discussion of instrumentation and measurement are aimed at the technician, and discussions of computational procedure are aimed at the junior engineer who has a background in basic hydraulics. The section on the design of gaging-station networks is written for the experienced hydrologist who plans such networks. (USGS)
W84-01049

2F. Groundwater

GROUND WATER RESOURCES IN FAYOUM AREA, EGYPT,
Zagazig Univ. (Egypt).
For primary bibliographic entry see Field 3A.
W84-00747

ORIGIN OF SUBSURFACE WATER IN KHARTOUM PROVINCE, SUDAN,
Zagazig Univ. (Egypt).
For primary bibliographic entry see Field 3A.
W84-00748

HYDROGEOLOGIC FEATURES OF THE ALLUVIAL DEPOSITS IN THE OWL CREEK VALLEY, BIGHORN BASIN, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. E. Cooley, and W. J. Head.
USGS Water-Resources Investigations 82-4007, December 1982. 33 p, 7 Fig, 9 Tab, 8 Ref.

Descriptors: *Geomorphology, *Groundwater, Water resources, Flood plains, Alluvium, *Wyoming, Rocky Mountain Region, *Terraces, *Alluvial aquifer, Alluvial fan, *Surficial geology, *Surface resistivity, Specific conductance, Bighorn basin.

The alluvial acquifer principally of the flood-plain alluvium and part of the Arapahoe Ranch terrace deposits and consists subordinately of alluvial-fan deposits. Thickness of the alluvial aquifer is generally 20 to 40 feet. Dissolved-solids concentration of water in the alluvial aquifer ranges from about 500 to more than 3,000 milligrams per liter. The most favorable areas for groundwater development are the flood-plain alluvium and part of the Arapahoe Ranch terrace deposits; however, in much of these units, the water contains more than 2,000 milligrams per liter of dissolved solids. Measurements of specific conductance of the flow of Owl Creek indicate a progressive increase in the down stream direction and range between 15 and 355 micromhos per centimeter at 25C per mile. The increases are due to return flow of irrigation water, inflow from tributaries, and inflow from groundwater. Conspicuous terraces in Owl Creek Valley included an unnamed terrace at 500 feet above Owl Creek, the Embar Ranch terrace 160 to 120 feet above the creek, and the Arapahoe Ranch terrace 50 to 20 feet above the creek. (USGS)
W84-00770

MODEL MODIFICATIONS FOR SIMULATION OF FLOW THROUGH STRATIFIED ROCKS IN EASTERN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 4C.
W84-00773

A THREE-DIMENSIONAL GROUND-WATER-FLOW MODEL MODIFIED TO REDUCE COMPUTER-MEMORY REQUIREMENTS AND BETTER SIMULATE CONFINING-BED AND AQUIFER PINCHOUTS,

Geological Survey, Trenton, NJ. Water Resources Div.
P. P. Leahy.
USGS Water-Resources Investigations 82-4023, 1982. 59 p, 4 Fig, 1 Tab, 6 Ref.

Descriptors: *Groundwater flow, *Finite-difference model, Computer memory, Model studies, Fortran program, Computer programs, Simulation, Aquifer pinchouts.

The Trescott computer program for modeling groundwater flow in three dimensions has been modified to (1) treat aquifer and confining bed pinchouts more realistically and (2) reduce the computer memory requirements needed for the input data. Using the original program, simulation of aquifer systems with nonrectangular external boundaries may result in a large number of nodes that are not involved in the numerical solution of the problem, but require computer storage. (USGS)
W84-00775

MODIFICATIONS AND CORRECTIONS TO THE FINITE DIFFERENCE MODEL FOR SIMULATION OF THREE-DIMENSIONAL GROUND-WATER FLOW,
Geological Survey, Reston, VA. Water Resources Div.
L. J. Torak.
USGS Water-Resources Investigations 82-4025, 1982. 67 p, 8 Ref.

Descriptors: *Aquifers, Mathematical models, Model studies, *Finite-difference methods, *Computer models, *Groundwater flow, Evapotranspiration, Streams, Springs, Drains, Iteration parameters.

This report describes modifications incorporated into the finite-difference model for simulation of groundwater flow in three dimensions. These modifications extend the application of this model to simulations involving head-dependent sources and sinks (i.e., rivers, evapotranspiration, and springs or drains). Other modifications are made that enhance the iterative-solution process of the Strongly Implicit Procedure (SIP). An acceleration (or dampening) factor is introduced to the matrix equation that is to be solved, and optional methods of computing iteration parameters are incorporated into the original model. This report also describes corrections to the model that eliminate errors in the equation formulation and in mass-balance computations of certain types of simulations. Additional data-input instructions, definitions of new variables, and a list of program-statement changes are given in an appendix. (USGS)
W84-00776

DIGITAL MODEL EVALUATION OF THE PREDEVELOPMENT FLOW SYSTEM OF THE TERTIARY LIMESTONE AQUIFER, SOUTHEAST GEORGIA, NORTHEAST FLORIDA, AND SOUTHERN SOUTH CAROLINA,
Geological Survey, Doraville, GA. Water Resources Div.
R. E. Krause.
USGS Open-File Report 82-173, May 1982. 27 p, 3 Fig, 3 Tab, 34 Ref, 7 Maps.

Descriptors: Groundwater, Carbonate rocks, *Confined aquifers, *Aquifer characteristics, *Computer models, *Groundwater movement, Groundwater budget, *Atlantic coastal plain, Georgia, Florida, South Carolina, Recharge-discharge relationships, Steady-state flow, Secondary permeability terrane.

A computer model using finite-difference techniques was used successfully to simulate the predevelopment flow regime within the multilayered Tertiary limestone aquifer system in Southeastern Georgia, Northeastern Florida, and Southern South Carolina as part of the U.S. Geological Survey's Tertiary Limestone Regional Aquifer System analysis. The aquifer, of early Eocene to Miocene age, ranges from thin interbedded clastics and marl in the updip area to massive limestone and dolomite 1,500 feet thick in the downdip area. The aquifer is confined above by Miocene clay beds, and terminates at depth in low-permeability rocks or the saltwater interface. Model-simulated transmissivity of the upper permeable zone ranged from about 1 x 10 super 3 foot squared per day in the updip area and within parts of the Gulf Trough (a series of alinement basins filled by fine clastic in material) to about 1 x 10 super 6 foot squared per day in South Georgia, and area having large secondarily developed solution channels. The model results indicate that only about 540 cubic feet per second of water flowed through the predeveloped system, from the updip highland area of high altitude and in the areas north of Valdosta and southwest of Jacksonville, to discharge along streams in the updip area and diffuse upward leakage in the downdip area near the coast and offshore. (USGS)
W84-00779

GEOLOGY AND GROUND WATER RESOURCES OF SUSSEX COUNTY AND THE WARREN COUNTY PORTION OF THE TOCKS ISLAND IMPACT AREA,
New Jersey Bureau of Geology and Topography, Trenton.
J. W. Miller, Jr.
Bulletin 73, January 1974. 143 p, 6 Fig, 12 Tab, 48 Ref.

Descriptors: *Groundwater availability, *Wells, *Drilling, *Well data, *Well logs, Hydrologic cycle, Groundwater storage, Aquifers, Water use, Geologic history, Water quality standards, Chemical properties, Groundwater movement, Water supply, Geohydrology.

Sussex County and the Warren County portion of the Tocks Island Impact Area of New Jersey are primarily agricultural. Commercial, industrial and resort development are occurring at an increasingly rapid rate. The counties can be prepared to meet the increased demand on ground and surface water only by continued research into water usage. The study of the geology and ground water resources of this area is part of a statewide program. Ground water supplies approximately 60% of the estimated daily water consumption in the study area. Water utilities furnish the balance from surface water or a combination of ground water and surface water. Most of the ground water is obtained from rock wells. There are no known areas where ground water levels have declined because of over pumping. Domestic supplies may be developed almost anywhere in the area. Moderate to large supplies can be developed from wells located in stratified drift, in cavernous members of the Kittatinny Formation, and in shear zones near faults. The quality of ground water is generally good for most uses. Locally the water will have to be treated for hardness, low pH, high iron content, and high S04. This investigation complies, interprets, and summarizes hydrologic information and records of 3,161 domestic, industrial, and public supply wells. (Fazio-Omniplan)
W84-00783

IRON IN GROUND WATERS OF THE MAGOTHY AND RARITAN FORMATIONS IN CAMDEN AND BURLINGTON COUNTIES, NEW JERSEY,
For primary bibliographic entry see Field 5B.
W84-00790

GEOLOGY AND GROUND WATER RESOURCES OF HUNTERDON COUNTY, NEW JERSEY,
H. F. Kasabach.
New Jersey Div. of Water Policy and Supply, Trenton, Special Report No 24, Trenton, 1966. 128 p, 13 Fig, 9 Tab, 39 Ref, 1 Append.

Descriptors: *Groundwater availability, *Geohydrology, *Water supply, *Water quality, Geology, Geologic mapping, Chemical analysis, Wells, Hardness, Geologic time, Well capacity, Test wells, Iron, Aquifers, Water level, *New Jersey, Hunterdon County.

Hunterdon County is one of three primarily agricultural counties in northwestern New Jersey. Commercial and industrial development is occurring at a rapid rate. The population and industry are almost wholly dependent on ground water which occurs in fractures and fissures in consolidated rocks. The quality of ground water is generally good for most uses. Locally the water may have to be treated for hardness, low pH, or high iron content. This report includes a total of 1,544 records of domestic, industrial, and public supply wells. The interpretations and conclusions presented are based on these drillers' records, which give a good indication of reasonable expectations of depth and yield for each formation. There are no known areas where ground water levels have declined because of excessive pumping. Domestic supplies may be developed almost anywhere. Moderate to large supplies can generally be developed from wells in the Triassic, Stockton Formation, and Brunswick Shale, which underlie approximately 45% of the county. Rough estimates of the maximum potential ground water withdrawals indicate that about 58 billion gallons per year of ground water is available to Hunterdon County, about seven times the estimated 1960 consumption. The investigation results will be of value as a guide for the proper development of the ground water resources of Hunterdon County as its economy develops. (Fazio-Omniplan)
W84-00791

WATER RESOURCES RESUME: STATE ATLAS SHEET NO. 23, PARTS OF BERGEN, MORRIS AND PASSAIC COUNTIES,
New Jersey Bureau of Geology and Topography, Trenton.
For primary bibliographic entry see Field 7C.
W84-00792

GEOLOGY AND GROUND-WATER RESOURCES OF SALEM COUNTY, NEW JERSEY,
J. C. Rosenau, S. M. Lang, G. S. Hilton, and J. G. Rooney.
New Jersey Department of Conservation and Economic Development, Special Report No 33, Trenton, 1969. 142 p, 21 Fig, 7 Tab, 25 Ref.

Descriptors: *Aquifers, *Aquifer characteristics, *Groundwater movement, *Groundwater potential, Groundwater level, Wells, Test wells, Saline water, Irrigation requirements, Irrigation, Long-term planning, Groundwater depletion, *New Jersey, Salem County.

This report discusses the geology pertinent to the development of the water resources of Salem County, New Jersey, the quality of the groundwater, and the problem of salt-water intrusion in each aquifer. Use of ground water in Salem County in 1964 averaged 12.28 mgd, or nearly 200 gpd per person. Industrial use was 5.33 mgd and use for public supply was 2.74 mgd. Irrigation, which has become increasingly important in recent years, accounted for 2.14 mgd. Average total summer use of ground water--approximately 17.7 mgd--was considerably higher than the yearly average. The Potomac Group and Raritan and Magothy Formations contain the most productive aquifers in Salem County. These aquifers are hydraulically connected in places and may be considered to form a single hydrologic unit or aquifer system. Reported yields of wells tapping this system range up to 860 gpm. A decline in water levels in this aquifer system has resulted from heavy pumpage. The aquifer in the Wenonah Formation and Mount Laurel Sand is the second most highly used aquifer in Salem County and is an important source of water for future development. Reported yields of wells tapping this aquifer range up to 507 gpm. Salt-water intrusion into the aquifer in the vicinity of the City of Salem is indicated by chloride concentrations of up to 396 gpm. The aquifer in the Vincentown Formation is an important aquifer in part of Salem County. It is capable of supplying considerably more water than is now being pumped and, hence, is important for future ground water development. Reported yields of wells tapping this aquifer range up to 270 gpm. (Garrison-Omniplan)
W84-00795

GEOLOGY AND GROUND-WATER RESOURCES OF THE RAHWAY AREA, NEW JERSEY,
H. R. Anderson.
New Jersey Department of Conservation and Economic Development, Special Report No 27, Trenton 1968. 72 p, 10 Fig, 6 Tab, 53 Ref.

Descriptors: *Groundwater movement, *Groundwater potential, *Groundwater availability, *Aquifer characteristics, *Aquifers, *Fracture permeability, Sandstones, Shales, Wells, Gypsum, Calcite, Groundwater level, Permeability, Brackish water, Glacial drift, *New Jersey, Rahway area, Union County, Middlesex County.

The quantity and quality of the groundwater resources in Rahway and adjacent areas in Union and Middlesex Counties is discussed. Brunswick Shale of the Triassic age underlies this area; it is blanketed by Wisconsin glacial drift ranging in thickness from several feet on hilltops to 100 feet in the terminal moraine. About 6 mgd is pumped from the Brunswick Shale, which yields water from fracture openings and from pore spaces in the interbedded sandstone. As depth increases, the fractures become smaller and fewer and yield less water. Recharge to the Brunswick occurs through the hydraulically continuous overlying drift. Both water-table and artesian conditions exist in the Brunswick Shale. The average yield of 150 industrial, public-supply and domestic wells is 75 gpm. Ground water from the Brunswick Shale is locally high in sulfate, dissolved solids, and hardness because of the solution of gypsum and calcite in the formation. Concentrations of these constituents increase with depth. Brackish water is contained in the Brunswick Shale along the tidal reach of the Rahway River and northward along the Arthur Kill. A stratified-drift deposit with an average thickness of 30 feet underlies the city of Rahway. More than a million gallons per day is pumped from four wells tapping both the drift and the underlying Brunswick Shale. The average yield of the wells is 370 gpm, and the average specific capacity is 15.3 gpm per foot. About 1 mgd is pumped from the Farrington Sand Member of the Raritan Formation. Twelve industrial wells have an average yield of 96 gpm. Tables of chemical analyses, well records and logs, and maps of the geology are included. (Garrison-Omniplan)
W84-00796

GROUND-WATER RESOURCES OF ESSEX COUNTY, NEW JERSEY,
W. D. Nichols.
New Jersey Department of Conservation and Economic Development, Special Report No 28, Trenton, 1968. 56 p, 13 Fig, 3 Tab, 15 Ref.

Descriptors: *Aquifer characteristics, *Aquifers, *Groundwater level, *Groundwater movement, *Groundwater depletion, *Pumpage, *Unconsolidated aquifers, *Sediments, Selective withdrawal, Subsurface water, Brackish water, Groundwater availability, Groundwater runoff, Groundwater potential, *New Jersey, Essex County.

The relative importance of the aquifers of Essex County, New Jersey are evaluated as to their present use and suitability for future development. The quality of ground water is acceptable for most uses throughout the county; however, heavy pumpage in the Newark area has lowered water levels to more than 100 feet below sea level. This has reversed the natural gradient and induced the flow of salt water into the bedrock aquifer, seriously impairing ground water quality. Recent analyses of ground water samples from Newark indicate that the chloride concentration in the aquifer has increased since the preliminary study of the problem by Herpers and Barksdale in 1951. Highly productive stratified drift deposits west of the Second Watchung Mountain are part of an extensive valley-fill aquifer system underlying the eastern Morris-western Essex County area. Water levels in these deposits in western Millburn Township have declined 36 feet since 1950, probably as a result of below normal rainfall for the period 1953 to 1966, together with constantly increasing pumpage throughout the area. Withdrawals of ground water from all aquifers in Essex County for public supply averaged 26 mgd in 1966. Pumpage for public supply from aquifers in unconsolidated sediments averaged 20.9 mgd, about 81% of the total from all aquifers. Most of the productive aquifers in Essex County are currently being developed. Large yields, ranging from 410 to 1,593 gpm, are common from wells tapping the stratified drift deposits. Their optimum potential probably has not been realized, but their development must be careful if the anticipated increase in water needs of the county are to be met. (Garrison-Omniplan)
W84-00797

WATER RESOURCES AND GEOLOGY OF GLOUCESTER COUNTY, NEW JERSEY,
W. F. Hardt, and G. S. Hilton.
New Jersey Department of Conservation and Economic Development, Trenton Special Report No 30, Trenton, 1969. 130 p, 17 Fig, 9 Tab, 6 Ref.

Descriptors: *Aquifer characteristics, *Groundwater availability, *Permeability coefficient, Wells, Chlorides, Permeability, Aquifers, Groundwater potential, Groundwater level, Pumping tests, Long-term planning, Coastal plains, Subsurface water, *New Jersey, Gloucester County.

A summary of the geology and water resources of Gloucester County, New Jersey is provided along with a discussion and evaluation of the major aquifers and their suitability for future development. The county is in the Coastal Plain and is underlain by unconsolidated sand and clay of Quarternary, Tertiary, and Cretaceous age. Water sufficient for domestic and farm supplies is available all over the county, usually from wells less than 200 feet deep. However, moderate to large amounts of water can be pumped economically only from the Raritan and Magothy Formations, the Cohansey Sand, and the Wenonal Formation and Mount Laurel Sand. The most important and productive aquifer is the Raritan and Mathoy Formations. The aquifer yields about 75% of the ground water used in the county. Wells tapping this aquifer yield up to 1,400 gpm and large capacity wells usually can be drilled almost anywhere in the county; however, high chlorides may be present in the southeastern parts of the county. Pumping tests indicate that the coefficients of transmissibility range from 30,000 to 68,000 gpd per foot. The aquifer is more permeable in the northwestern part of the county. The Cohansey Sand of Tertiary age is the second most important aquifer in the county and has the greatest potential for future development. Pumping tests at Clayton and Williamstown indicate a coefficient of transmissibility of about 60,000 gpd per foot. The undifferentiated Wenonah Formation and Mount Laurel Sand are capable of yielding 100 to 200 gpm to wells. Total ground water pumpage in the county in 1966 was estimated about 40 mgd. (Garrison-Omniplan)
W84-00798

GEOLOGY OF THE GROUND WATER RESOURCES OF MERCER COUNTY,
New Jersey Bureau of Geology and Topography, Trenton.
K. Widmer.
New Jersey Geological Survey, Geologic Report Series No 7, Trenton, 1965. 115 p, 5 Fig, 18 Ref, 4 Append.

Descriptors: *Well yield, *Well data, *Water yield, *Groundwater availability, *Canals, Reservoirs, River flow, Rivers, Data collections, Groundwater level, Subsurface water, Sandstones, Shales, Industrial water use, *New Jersey, Mercer County.

All water supplies in Mercer County, New Jersey are derived from the Delaware River; the Raritan Canal; wells; or surface water from farm ponds, impoundments, or minor streams. There are both legal and physical limits as to the amount of water which can be taken from the canal and utilized in different parts of Mercer County. Well records on more than 1,000 household and industrial wells were used in this study. Data from the records were tabulated by geologic formation, by township, and for special or local problems. Detailed analyses of well records indicate that (1) there is no correlation between well depth and yield; (2) the availability of ground water decreases in wells over several hundred feet deep; (3) each formation has its own characteristic high and low yields; and (4) there are varying limits to the amount of water which can be safely drawn from a unit area of each formation. Successful wells can be located near minor geologic structures which are revealed by topographic features. About one-half of the domestic wells drilled into argillite, basalt, or pre-Triassic crystalline rocks yield insufficient water. A second well or deeper well may be needed. Large capacity industrial wells can generally obtain only enough water from the Raritan formation. Industrial wells in the Stockton sandstone and Brunswick shale usually yield about 100 gpm. The pre-Triassic crystalline rocks yield from 20 to 50 gpm. The thick Pleistocene deposits of central Mercer County are dry in some areas, in others will supply enough water for domestic and small industrial requirements, and, in a few restricted areas, have supplied large capacity wells. (Garrison-Omniplan)
W84-00799

USE OF A THREE-DIMENSIONAL MODEL FOR THE ANALYSIS OF THE GROUND-WATER FLOW SYSTEM IN PARKER VALLEY, ARIZONA AND CALIFORNIA,
Geological Survey, Tucson, AZ. Water Resources Div.
P. Tucci.
USGS Open-File Report, 82-1006, December 1982. 54 p, 14 Fig, 1 Tab.

Descriptors: *Alluvial aquifers, *Computer models, *Groundwater budget, *Groundwater recharge, *Unconfined aquifers, Model studies, Areal hydrogeology, Groundwater basins, Evapotranspiration, Consumptive use, Groundwater, Hydraulic conductivity, Rivers, Southwest U. S., *Arizona, *California, Parker Valley, *Colorado River, Colorado River alluviums, Bouse Formation Transfer value, Surface-groundwater relations.

A three-dimensional, finite-difference model was used to simulate ground-water flow conditions in Parker Valley. The study evaluated present knowledge and concepts of the ground-water system and the ability of the model to represent the system. Modeling assumptions and generalized physical parameters that were used may have transfer value in the construction and calibration of models of other basins along the lower Colorado River. The aquifer was simulated in two layers to represent the three-dimensional system. Ground-water conditions were simulated for 1940-41, the mid-1960's, and 1980. Overall model results generally compared favorably with available field information. The model results showed that for 1940-41 the Colorado River was a losing stream through out Parker Valley. Infiltration of surface water from the river was the major source of recharge. The dominant mechanism of discharge was evapotranspiration by phreatophytes. Agricultural development between 1941 and the mid-1960's resulted in significant changes to the ground-water system. Model results for conditions in the mid-1960's showed that the Colorado River had become a gaining stream in the northern part of the valley as a result of higher water levels. The rise in water levels was caused by infiltration of applied irrigation water. Diminished water-level gradients from the river in the rest of the valley reduced the amount of infiltration of surface water from the river. Models results for conditions in 1980 showed that ground-water level rises of several feet caused further reduction in the amount of surface-water infiltration from the river. (USGS)
W84-00823

STATISTICAL SUMMARIES OF SELECTED CHEMICAL CONSTITUENTS IN KANSAS GROUND-WATER SUPPLIES,
Geological Survey, Lawrence, KS. Water Resources Div.
T. B. Spruill.
USGS Open-File Report 83-263, 1983. 29 p, 11 Fig, 10 Tab, 8 Ref.

Descriptors: *Water quality data, *Groundwater, *Statistical analysis, Water quality standards, Phy-

siographic provinces, *Kansas, Groundwater quality monitoring network.

Data on 24 chemical constituents or properties obtained from 766 wells in the Kansas groundwater quality monitoring network between 1976 and 1981 are statistically summarized in this report prepared in cooperation with the Kansas Department of Health and Environment. Minimum, median, and maximum concentrations and percentage of samples above the 'maximum contaminant levels' established by the U.S. Environmental Protection Agency are presented for all wells in the statewide network. More detailed areal statistical summaries are presented for all wells in the statewide network. More detailed areal statistical summaries are presented for nine chemical constituents for which more than 3% of the observed concentrations exceeded the 'maximum contaminate level' for that constituent. The State was divided into 14 ground-water regions based on water-use and physiographic characteristics. Summaries for these nine constituents include quartile values and percentage of samples with concentrations above the 'maximum contaminant level' for each ground-water region. Accompanying figures show median concentrations and percentages of concentrations exceeding the 'maximum contaminant levels' established by the U.S. Environmental Protection Agency for each ground-water region. (USGS)
W84-00869

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1981,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. R. Cruz.
Available from OFSS, USGS, Lakewood, CO 80225; Paper copy $3.00, Microfiche $3.50. USGS Open-File Report 82-757, 1982. 31 p, 10 Fig, 5 Tab, 5 Ref.

Descriptors: *Hydrologic data, *Groundwater, *New Mexico, Potentiometric level, *Water quality, *Slope-area measurement, Peak flow, Military installation, White Sands Missile Range.

Ground-water data were collected in 1981 at White Sands Missile Range in south-central New Mexico. The total amount of water pumped at White Sands Missile Range was approximately 59 million gallons less than in 1980; however the five supply wells in the Range areas adjacent to the Post Headquarters area produced approximately 16.2 million gallons more in 1981 than in 1980. Depth-to-water measurements in the Post Headquarters supply wells continued to show seasonal declines. (USGS)
W84-00872

A PLAN FOR HYDROLOGIC INVESTIGATIONS OF IN-SITU OIL SHALE RETORTING NEAR ROCK SPRINGS, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
K. C. Glover, E. A. Zimmerman, L. R. Larson, and J. C. Wallace.
Available from the OFSS, USGS Lakewood, CO 80225, Price $2.75 in paper copy, $3.75 in microfiche. USGS Open-File Report 82-758, October 1982. 27 p, 7 Fig, 18 Ref.

Descriptors: *Oil shale, Project planning, Groundwater movement, *Wyoming, Water quality, Computer models, Solute transport, In-situ retorting.

The recovery of shale oil by the in-situ retort process may cause hydrologic impacts, the most significant being ground-water contamination and possible transport of contaminants into surrounding areas. Although these impacts are site-specific, many of the techniques used to investigate each retort operation commonly will be the same. The U.S. Geological Survey has begun a study of hydrologic impacts in the area of an in-situ retort near Rock Springs, Wyoming, as a means of refining and demonstrating these techniques. Geological investigations include determining the areal extent and thickness of aquifers. Emphasis will be placed on determining lithologic variations from geophysical logging. Hydrologic investigations include mapping of potentiometric surfaces, determining rates of ground-water discharge, and estimating aquifer properties by analytical techniques. Water-quality investigations include monitoring solute migration from the retort site and evaluating sampling techniques by standard statistical procedures. A ground-water-flow and solute-transport model will be developed to predict future movement of the water plume away from the retort. (USGS)
W84-00873

PRELIMINARY SURVEY OF GROUNDWATER RESOURCES FOR ISLAND COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
D. R. Cline, M. A. Jones, N. P. Dion, K. J. Whiteman, and D. B. Sapik.
Available from the USGS, OFSS, Lakewood, CO 80225, Paper copy $6.50, Microfiche $3.50. USGS Open-File Report 82-561, 1982. 46 p, 26 Fig, 19 Ref.

Descriptors: *Groundwater discharge, Groundwater recharge, *Aquifers *Freshwater-saline water interfaces, Intrusion, Island County, *Washington, Camano Island, Whidbey Island.

Increased ground-water withdrawals associated with the population increase in Island County have caused concern about ground-water availability and potential seawater intrusion. The most widespread and widely used aquifer lies near sea level. Locally, available data also indicate that one or more water-bearing zones lie above the sea-level aquifer. Pumpage in 1979 totaled about 1.67 billion gallons; about 90% was pumped from the sea-level aquifer. Most large producing wells in the county have pumping water levels near or below sea level, so that if pumping continued for a long enough time, seawater intrusion would result. Sampling of chloride concentrations in July 1978, April 1980, and August 1980 indicated problem areas mainly in northeastern and southern Camano Island and in central Whidbey Island. (USGS)
W84-00878

GROUND-WATER CONDITIONS IN THE EASTERN PART OF MICHAUD FLATS, FORT HALL INDIAN RESERVATION, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
N. D. Jacobson.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $4.75 in paper copy. USGS Open-File Report 82-570, June 1982. 35 p, 7 Fig, 6 Tab, 22 Ref.

Descriptors: *Water quality, *Heavy metals, *Confined aquifers, Arsenic, *Groundwater, *Idaho, Fort Hall Indian Reservation, Michaud Flats, Snake River Plain.

The Michaud Flats study area occupies about 20 square miles on the Snake River Plain in southeastern Idaho: Ground-water resources are extensively developed for irrigation and industrial uses. The more productive wells are completed in the Pediment Gravel and the basalt flows of the Bighole Basalt and Starlight Formation and the sand and gravel of the Sunbeam Formation. A few shallow domestic wells are completed in the water-table aquifer in the Michaud Gravel. Historically, high levels of arsenic were observed in water from several wells completed in the shallow aquifer. In most wells and springs sampled during this study, levels of arsenic and other minor elements were within limits recommended by the U.S. Public Health Service. Heavy metal concentrations in one well completed in the shallow aquifer, and the concentration of arsenic exceeded the recommended limits. There is some evidence that arsenic, as well as several other minor elements, may occur in above-normal levels naturally in local ground water. Ground water used for irrigation generally has a low sodium-absorption ratio and can be used on almost all soils. All irrigation water sampled have a medium to high salinity hazard, and caution should be used when applying these waters on poorly drained soils. (USGS)
W84-00879

GROUND WATER FOR PUBLIC SUPPLY AT WINDIGO, ISLE ROYALE NATIONAL PARK, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
N. G. Grannemann, and F. R. Twenter.
USGS Open-File Report 82-567, 1982. 16 p, 4 Fig, 3 Tab, 5 Ref.

Descriptors: *Water supply, *Groundwater, Precambrian rocks, Isle Royale Nation Park, *Michigan.

Three test holes drilled at Windigo in Isle Royale National Park in 1981 indicate that the ophitic basaltic lava flows underlying the area contain little water and cannot be considered a source for public water supply. The holes were 135, 175, and 71 feet deep. One hole yielded about 1 gallon of water perminute; the other two yielded less. Glacial deposits seem to offer the best opportunity for developing a ground-water supply of 5 to 10 gallons per minute. (USGS)
W84-00880

PREDEVELOPMENT FLOW IN THE TERTIARY LIMESTONE AQUIFER, SOUTHEASTERN UNITED STATES: A REGIONAL ANALYSIS FROM DIGITAL MODELING,
Geological Survey, Atlanta, GA. Water Resources Div.
P. W. Bush.
USGS Water-Resources Investigations 82-905, 1982. 41 p, 12 Fig, 2 Tab, 34 Ref.

Descriptors: *Carbonate aquifers, *Limestone, *Model studies, *Groundwater movement, *Aquifer characteristics, Groundwater recharge, Groundwater budget, Confined aquifers, Coastal aquifers, *Floridan aquifer, Principal artesian aquifer, *Southeast U.S.

The Tertiary limestone aquifer of the southeastern United States is a sequence of carbonate rocks that underlies all of Florida, south Georgia, and adjacent parts of Alabama and South Carolina. The aquifer includes various carbonate units of Paleocence to early Miocene age that are hydraulically connected in varying degrees. In general the aquifer consists of either one vertically continuous permeable zone or two major permeable zones separated by a less permeable unit of highly variable-water-transmitting characteristics. Digital model simulation shows that prior to development, most flow in the aquifer occurred in the unconfined and thinly confined areas of northwest and central Florida and southwest Georgia. Springs in these areas are visible evidence of major flow activity. Spring discharge to streams accounted for about 90% of the average predevelopment discharge from the regional aquifer. About 18,100 ft super 3/s left the limestone aquifer as spring flow, and 2,500 ft super 3/s discharged as diffuse upward leakage from the confined areas where the vertical head gradient was upward. Most of the 20,600 ft super 3/s recharge necessary to balance total discharge entered the limestone aquifer in the unconfined and thinly confined spring areas. A very active shallow flow system at the expense of deep circulation has evolved in unconfined and slightly confined spring areas. In contrast, predevelopment flow in the aquifer in the thickly confined areas of southeast and coastal Georgia, far west Florida, and in south Florida was extremely sluggish. Thick overburden severely retards discharge from the aquifer, causing lethargic flow in these three areas. Large-discharge springs are nonexistent. (USGS)
W84-00884

A NATURAL RESOURCE AND LAND USE ANALYSIS OF THE LACONA WILLIAMSTOWN PORTION OF THE TUG HILL AQUIFER.
Oswego County Planning Board, NY.
Report, June 1983. 89 p, 13 Fig, 12 Tab, 11 Ref, 2 Append.

Descriptors: *Aquifers, *Natural recharge, *Sand aquifers, *Sand, *Aeolian soils, *Soil classification, *Recharge, Soil formation, Gravel, Silt, Soil types, Groundwater recharge, *New York, Tug Hill aquifer.

The Lacona-Williamstown Aquifer in Oswego County, New York, has as its boundary a line along County Route 48, New York Route 13, and from New York Route 183 to Nichols Road and Finnerty Road in the Town of Amboy. A natural resources and land use analysis of the aquifer reveals that its water-bearing deposits are beach, outwash, kamic, and deltaic sands and gravels. Till, aeolian sands, lacustrine silt and fine sand, alluvium, and organic matter are also found in the study area. These deposits are the parent material for a total of nineteen soil associations found in the Lacona-Williamstown Aquifer. Most of these soils, particularly those derived from sand and gravel, are well-suited for a variety of land uses. They have a relatively high agricultural potential, a high corrosion potential to concrete and a low corrosion potential to untreated steel. They are most suited for sanitary leach fields, but have a low phosphorus adsorption capacity. Because of this, improper agricultural management practices may pose a long-term threat to groundwater quality. Recharge in the aquifer occurs where sand and gravel soils overlay sand and gravel deposits; the study area largely constitutes its own recharge area. The dominant land uses throughout the study area are low density residential, agriculture, and forest. Medium density residential and industrial uses occur within or in proximity to four towns. (Garrison-Omniplan)
W84-00913

GROUND WATER: A NON-TECHNICAL GUIDE,
Academy of Natural Sciences of Philadelphia, PA.
J. Wilson.
Academy of Natural Sciences, Philadelphia, PA., 1982. 105 p, 36 Fig, 32 Ref.

Descriptors: *Groundwater availability, *Groundwater potential, *Groundwater recharge, *Surface groundwater relations, *Groundwater flow, Groundwater movement, Groundwater basins, Agricultural runoff, Public policy, Water policy, Industrial wastewater, Political aspects.

Ground water, the water stored in aquifers located beneath the surface of the earth, is a complex natural resource. Whether an aquifer is made of dense crystalline rock or loosely packed gravel will determine whether it is a poor or prolific source of water. Ground water provides the base flow for many of the nation's streams and is a source of much of the water in lakes. It is a principal source of drinking water. The actual size of the ground water supply in the United States is not known with any degree of certainty. Protecting recharge areas and limiting the withdrawal of ground water poses serious policy questions. There is general agreement that steps should be taken to mitigte the contamination of ground water. It is recognized that the best way of achieving this goal is likely to be highly site specific. Federal management of activities which impact upon ground water may be advisable. Among the topics covered in the guide are the natural factors which influence ground water, human settlements and their impact on ground water, agricultural activities and ground water, and industrial activities and ground water. (Garrison-Omniplan)
W84-00915

GROUND WATER AND GEOLOGY OF MARQUETTE COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
C. J. Doonan, and J. L. Van Alstine.
USGS Open-File Report 82-501, 1982. 46 p, 7 Fig, 7 Tab, 20 Ref.

Descriptors: *Groundwater, Aquifers, *Aquifer characteristics, Water wells, Water supply, Geology, *Hydrogeology, *Michigan.

Ground-water resources of Marquette County are about evenly divided between bedrock aquifers and aquifers in glacial deposits. In the northern and the extreme southern parts of the county, most wells are completed in bedrock at depths less than 100 feet. Yields, from most wells in bedrock range between 3 and 40 gal/min. In central Marquette County most wells are completed in glacial deposits; some of these wells are as much as 200 feet deep. Yields from wells in galcial deposits may be as great as 200 gal/min. Most well water is hard and has iron concentrations ranging from less than 0.1 mg/L to about 5.0 mg/L. Both ground water and surface water are used in municipal water systems in Marquette County. (USGS)
W84-00925

DATA FOR GROUND-WATER TEST HOLE NEAR ZAMORA, CENTRAL VALLEY AQUIFER PROJECT, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00927

CONTINUOUS SEISMIC-REFLECTION SURVEY DEFINING SHALLOW SEDIMENTARY LAYERS IN THE CHARLOTTE HARBOR AND VENICE AREAS, SOUTHWEST, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. M. Wolansky, F. P. Haeni, and R. E. Sylvester.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-215731, Price codes: A05 in paper copy, A01 in microfiche. USGS Water-Resources Investigations 82-57, 1983. 77 p, 16 Fig, 4 Tab, 16 Ref.

Descriptors: *Geophysics, *Seismic studies, Survey, Geohydrologic units, Hydrogeology, Water-bearing formations, Sediments, *Florida, Surficial aquifer, Intermediate aquifers, Floridan aquifer.

A continuous marine seismic-reflection survey system was used to define the configuration of shallow sedimentary layers underlying the Charlotte Harbor and Venice areas, southwest Florida. Seismic profiling was conducted over a distance of about 57 miles of Charlotte Harbor, the Peace and Myakka Rivers, and the Intracoastal Waterway near Venice using a high resolution energy source capable of penetrating 200 feet of sediments with a resolution of 1 to 3 feet. Five stratigraphic units defined from the seismic records includes sediments to Holocene to early Miocene age. All seismic-profile records are presented, along with geologic sections constructed from the records. Seismic reflection amplitude, frequency, continuity, configuration, external form, and areal association were utilized to interpret facies and depositional environments of the stratigraphic units. The depositional framework of the units ranges from shallow shelf to prograded slope. The stratigraphic units are correlated with the surficial aquifer and intermediate artesian aquifers, and permeable zones of the aquifers are related to the seismic records. (USGS)
W84-00929

GROUND-WATER RESOURCES OF THE WHITE RIVER BASIN, HAMILTON AND TIPTON COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
L. D. Arihood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-184309, Price codes: A05 in paper copy, A01 in microfiche. USGS Water Resources Investigation 82-48, November 1982, 69 p, 35 Fig, 5 Tab, 19 Ref.

Descriptors: *Aquifers, Aquifer characteristics, Glacial drift, *Groundwater movement, Groundwater recharge, Groundwater resources, *Indiana, Model studies, Observation wells, Seepage, Surface-water and groundwater relationships, Water-level fluctuation, Glacial outwash, Groundwater model, Groundwater withdrawal, Hamilton County, Saturated thickness, Streamflow depletion, Tipton County, *White River basin.

The ground-water resources of the White River basin in Hamilton and Tipton Counties were investigated by first collecting driller logs, groundwater levels, streamflow measurements, and pumping data. These data were used to map the aquifers and construct both two- and three-dimensional ground-water flow models, which provided estimates of the ground-water potential in terms of yield, drawdown, and streamflow depletion. Five confined sand and gravel aquifers interbedded in till a bedrock aquifer, and an unconfined outwash aquifer are the three major aquifer systems. A 39-million-gallons-per-day pumpage was simulated from the outwash aquifer by the two-dimensional model. Pumping was simulated at a rate that reduced the modeled saturated thickness of the aquifer at the wells by half. Pumping in the confined sand and gravel and bedrock aquifers was simulated by three-dimensional model. In this case, pumpage was simulated over smaller areas than in the outwash aquifer, and pumping plans assessed specific types of conditions, such as extent or thickness of a sand and gravel unit. Simulated pumpages ranged from 1.9 to 6.7 million gallons per day. The highest pumpages were closest to major discharge areas. (USGS)
W84-00930

GROUND-WATER RESOURCES OF THE WHITE RIVER BASIN, DELAWARE COUNTY, INDIANA, 1977,
Geological Survey, Indianapolis, IN. Water Resources Div.
L. D. Arihood, and W. W. Lapham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196147, Price codes: A05 in paper copy, A01 in microfiche. USGS Water Resources Investigation 82-47, September 1982. 69 p, 40 Fig, 5 Tab, 20 Ref.

Descriptors: *Aquifer, *Aquifer characteristics, Glacial drift, *Groundwater movement, Groundwater recharge, *Indiana, Model studies, Observation wells, Seepage, Streamflow depletion, Surface-groundwater relationships, Water-level fluctuation, Groundwater model, Groundwater resources, Groundwater withdrawal, Randolph County, *White River basin.

The ground-water resources of the White River basin in and near Delaware County, Indiana, were investigated by mapping the aquifers, calculating their hydraulic properties, determining the distribution of potentiometric head in the aquifers, and determining some of the components of the ground-water budget from data collected in the field. This information was used to construct and calibrate a seven-layer digital ground-water flow model. The model was used to assess ground-water potential in terms of yield, drawdown, and depletion in streamflow. Six confined sand and gravel aquifers interbedded in the drift, an unconfined outwash aquifer, and a bedrock aquifer are the three most important aquifer systems in the study area. Model analysis of seven pumping plans provides a general assessment of the water-yielding potential of the three major aquifer systems in the study area. Results indicate that yields of as much as 3.0 million gallons per day can be developed at some locations. Model simulations also indicate that pumping will generally decrease flow in streams by no more than 10% discharging more than 2 cubic feet per second. (USGS)
W84-00931

GEOHYDROLOGIC RECONNAISSANCE OF LAKE MEAD NATIONAL RECREATION AREA--LAS VEGAS WASH TO OPAL MOUNTAIN, NEVADA,
Geological Survey, Reston, VA. Water Resources Div.
R. L. Laney.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $8.00 in paper copy, $4.00 in microfiche. USGS Open-Filed Report 82-115, December 1981. 23 p, 3 Fig, 2 Tab, 25 Ref.

Descriptors: *Hydrogeology, *Groundwater, *Water quality, *Geologic control, Lake Mead National Recreation Area, *Nevada.

The study is a geohydrologic reconnaissance of about 170 square miles in the Lake Mead National Recreation Area from Las Vegas Wash to Opal Mountain, Nevada. The study is one of a series that describes the geohydrology of the recreation area and that indentifies areas where water supplies can be developed. Precipitation in this arid area is about 5 inches per year. Streamflow is seasonal and extremely variable except for that in the Colorado River, which adjoins the area. Pan evaporation is more than 20 times greater than precipitation; therefore, regional ground-water supplies are meager except near the Colorado River, Lake Mead, and Lake Mohave. Large ground-water supplies can be developed near the river and lakes, and much smaller supplies may be obtained in a few favorable locations farther from the river and lakes. Ground water in most of the areas probably contains more than 1,000 milligrams per liter of dissolved solids, but water that contains less than 1,000 milligrams per liter of dissolved solids can be obtained within about 1 mile of the lakes. Crystalline rocks of metamorphic, intrusive and volcanic origin crop out in the area. These rocks are overlain by conglomerate and mudstone of the Muddy Creek Formation, gravel and conglomerate of the older alluvium, and sand and gravel of the Chemehuevi Formation and younger alluvium. The crystalline rocks, where sufficiently fractured, yield water to springs and would yield small amounts of water to favorably located wells. The poorly cemented and more permeable beds of the older alluvium, Chemehuevi Formation, and younger alluvium are the better potential aquifers, particularly along the Colorado River and Lakes Mead and Mohave. Thermal springs in the gorge of the Colorado River south of Hoover Dam discharge at least 2,580 acre-feet per year of water from the volcanic rocks and metamorphic and plutonic rocks. The discharge is much greater than could be infiltrated in the drainage basin above the springs. Transbasin movement of ground water probably occurs, and perhaps the larger part of the spring discharge is underflow from Eldorado Valley. The more favorable sites for ground-water development are along the shores of Lakes Mead and Mohave and are the Fire Mountain, Opal Mountain to Aztec Wash, and Hemenway Wash sites. Wells yielding several hundred gallons per minute of water of acceptable chemical quality can be developed at these sites. (USGS)
W84-00934

HYDROLOGIC DATA FROM MONITORING OF SALINE-WATER INTRUSION IN THE CAPE CORAL AREA, LEE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00935

POTENTIAL HYDROLOGIC IMPACTS OF GROUND-WATER WITHDRAWALS FROM THE CAPE COD NATIONAL SEASHORE, TRURO, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
D. R. LeBlanc.
USGS Open-File Report 82-438, 1982. 42 p, 26 Fig, 5 Tab, 16 Ref.

Descriptors: *Aquifers, Computer models, *Groundwater, Pumping, Water-level fluctuations, *Discharge, *Saline-water intrusion, Cape Cod National Seashore, *Withdrawal, Hydrologic impacts, Glacial outwash, *Massachusetts.

The hydrologic impacts of continuous groundwater withdrawals at 0.75, 1.0, and 1.24 Mgal/d (million gallons per day) from a test-well site in the Cape Cod National Seashore, Truro, Massachusetts, were evaluated with a three-dimensional finite-difference steady-state-flow digital model. The digital model was prepared during an earlier study and is only briefly described. Continuous withdrawal of more than 1.0 Mgal/d from a well screened from 10 to 40 feet below sea level at the test site will result in upward movement of the freshwater-saltwater interface, and most likely saltwater will eventually contaminate the well. Pumping from a shallower well will decrease the potential for the movement of saltwater into the well, but the water table may be drawn down to the well screen. It is unlikely that movement of the freshwater-saltwater interface in response to pumping from the test site at the simulated rates will result in saltwater contamination of the shallow domestic supply wells in Truro. For the simulated pumping schemes, the water-table decline below average (1963-76) levels did not exceed 0.6 foot except near the pumping wells. Continuous withdrawal at the average year-round rate and the average summer rate will decrease freshwater discharge to the wetland and ocean along the northeastern boundary of the aquifer. (USGS)
W84-00944

RECONNAISSANCE OF GROUND-WATER QUALITY, EASTERN SNAKE RIVER BASIN, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
D. J. Parliman.
USGS Water-Resources Investigations Report 82-4004, March 1983. 99 p, 19 Fig, 6 Tab, 45 Ref.

Descriptors: *Groundwater, *Water quality, Water quality standards, Baseline studies, Aquifers, *Chemical analyses, Hydrogeology, *Water wells, *Data collections, Hydrologic data, Geologic data, *Idaho, Snake River basin, Teton River, Mud Lake-Market Lake basin.

Water-quality, geologic, and hydrologic data were collected for 165 wells in the eastern Snake River basin, Idaho. Water-quality characteristics analyzed include specific conductance, pH, water temperature, major dissolved cations and anions, and coliform bacteria. Ground water from aquifers in all rock units is generally composed of calcium, magnesium, and bicarbonate type and contains carbonate ions. Changes in area trends of groundwater composition probably are most directly related to variability in aquifer composition and proximity to varying sources of recharge, especially those related to man's land- and water-use activities. In the uplands subareas, median values for selected ground-water characteristics from current analyses are 2000 mg/l hardness; 7.6, pH; 200 mg/l alkalinity; 13C; 0.2 mg/l fluoride; 15 mg/l silica; 0.51 mg/l nitrite (as nitrogen); less than 1 colony per 100 milliliters of water coliform bacteria; 0.02 mg/l phosphorus (total); and 25 mg/l hardness; 7.7, pH; 180 mg/l alkalinity; 11C; 0.4 mg/l fluoride; 26 mg/l silica; 1.2 mg/l nitrite plus nitrate; less than 1 colony per 100 milliliters of water coliform bacteria; 0.01 amg/l phosphorus; and 283 mg/l dissolved solids. Ground-water quality in most of the study area meets recommended standards or criteria for most uses. (USGS)
W84-00974

MAJOR AQUIFERS IN HANSON AND DAVISON COUNTIES, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
D. S. Hansen.
South Dakota Geological Survey, Vermillion, Information Pamphlet No 26, 1983. 11 p, 4 Fig.

Descriptors: *Aquifers, *Hydrogeology, *Groundwater, Water quality, *South Dakota, Davison County, Hanson County.

Five glacial-deposit and three bedrock aquifers underlie much of Hanson and Davison Counties, South Dakota. The Floyd and Plum Creek glacial-deposit aquifers range in thickness from 5 to 87 feet and may yield as much as 1,000 gallons per minute to wells. The Ethan, Warren, and Alexandria glacial-deposit aquifers range in thickness from 5 to 37 feet and well yield may be as much as 400 gallons per minute. Water in the Floyd and Ethan aquifers is of the sodium calcium sulfate type; in the Plum Creek and Warren aquifers, water is of the calcium magnesium sulfate type; and in the Alexandria aquifer, water is of the calcium magnesium bicarbonate type. In all the glacial-deposit aquifers, dissolved-solids concentrations ranged from 210 to 2,740 milligrams per liter. The Niobrara Chalk, Codell Sandstone, and Dakota Sandstone of Cretaceous age are the major sources of water from bedrock aquifers. Yields from these aquifers range from 2 to 1,000 gallons per minute. Water from the Niobrara aquifer is of sodium calcium sulfate type; in the Codell aquifer, water is of the sodium sulfate type; and in the Dakota aquifer, water is of the calcium magnesium sulfate type. Water from all three aquifers is used for stock watering and domestic purposes. Water from the Niobrara also is used for irrigation. (USGS)
W84-00978

MAJOR AQUIFERS IN YANKTON COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
E. F. Bugliosi.
South Dakota Geological Survey, Vermillion, Information Pamphlet No 28, 1983. 7 p, 3 Fig.

Descriptors: *Aquifers, *Hydrogeology, *Groundwater, Water quality, *South Dakota, Yankton County.

The Lower Vermillion-Missouri glacial aquifer underlies 240 square miles of the county. It ranges in thickness from 100 feet in the southeast to more than 400 feet under James Ridge in the northwest part of the county. It has the potential to supply 1,000 gallons per minute to individual wells. The aquifer is generally penetrated within 100 feet of the land surface. The dominant dissolved chemical constituents in the water are calcium, magnesium, and bicarbonate. The water is very hard, averaging 870 milligrams per liter. Dissolved solids range from 560 to 2,360 milligrams per liter. The Niobrara aquifer underlies about 238 square miles in the northeast and southwest parts of the county. It reaches thicknesses of more than 250 feet. Potential well yields are generally not large enough for irrigation. Calcium, magnesium, and bicarbonate are the dominant ions in the water. Hardness averages 1,162 milligrams per round of liter and dissolved solids range from 1,240 to 2,740 milligrams per liter. The Dakota aquifer underslies all of Yankton County. The depth from land surface to the aquifer ranges from about 300 feet to about 500 feet. Wells completed in the aquifer can be expected to produce from 10 to 40 gallons per minute. The dominant ions in the water are calcium, magnesium, and sulfate. Water hardness averages 1,150 milligrams per liter and, dissolved solids range from 1,790 to 2,030 milligrams per liter. (USGS)
W84-00979

GROUND-WATER DATA FOR GEORGIA, 1981,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00986

OCCURRENCE AND USE OF GROUND WATER IN THE VENICE-ENGLEWOOD AREA, SARASOTA AND CHARLOTTE COUNTIES, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 6D.
W84-00987

APPRAISAL OF WATER FROM THE PELICAN RIVER SAND-PLAIN AQUIFER, WEST-CENTRAL MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
R. T. Miller.
USGS Open-File Report 82-347, August 1982. 44 p, 16 Fig, 6 Tab, 40 Ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, Water quality, Hydrologic models, Pelican River sand-plain aquifer, Becker County, Otter Trail County, Clay County, *Minnesota.

The Pelican River sand-plain area includes approximately 200 squares miles of outwash deposits in parts of Becker, Otter Trail, and Clay Counties in west-central Minnesota. Saturated thickness of the outwash is as much as 140 feet and yields and

properly constructed wells locally may exceed 1,200 gallons per minute. Recharge to the outwash from snowmelt and rain ranged from 3.2 to 6.1 inches in 1979-80. Discharge from the aquifer, as base flow of the Pelican River averaged 2.0 inches for 1979-80. Evapotranspiration is 22.4 inches per year. The chemical quality of ground-water is suitable for irrigation as measured by sodium-adsorption ratios, but locally high concentrations of calcium, magnesium, and bicarbonate may cause clogging of well screens. Mathematical models of parts of the ground-water-flow system indicate that lake levels and streamflow may decline due to pumping wells. The exact water-level decline is dependent on the total number of wells, pumping rates, location of pumping wells with respect to one another and surface-water bodies, duration of pumping, and the amount of ground-water recharge. Sensitivity analyses of the models indicates that additional data on hydraulic conductivity, evapotranspiration, and recharge may increase the reliability of model results. Buried aquifers are known to be present in the area. Aquifer-test results showed that pumping from a buried aquifer had no effect on water levels in the unconfined aquifer. (USGS)
W84-00988

GROUND WATER IN THE SEASIDE AREA, MONTERREY COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
K. S. Muir.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-149229, Price codes: A03 in paper copy, A01 in microfiche.
USGS Water Recharge Investigations Report 82-10, September 1982. 37 p, 10 Fig, 7 Tab, 29 Ref.

Descriptors: *Groundwater reservoirs, *Groundwater recharge, Groundwater storage, Yield, Monterrey County, Seaside, *California.

The ground-water resources in the Seaside area, in central coastal Monterrey County, is described and evaluated. The Santa Margarita Sandstone, Paso Robles Formation, Aromas Sand, and the Older Dunes, with an aggregate maximum thickness of more than 1,000 feet, constitute the ground-water reservoir. The Monterrey Shale and granitic rocks form the bottom and southern boundaries of the reservoir. Recharge to the ground-water reservoir occurs as infiltration of rain, subsurface inflow from adjacent areas, and seepage from streams. Rain infiltration accounts for about 75% of the recharge. Most of the area is classified as having a good-to-fair recharge potential. Areas in the east and along the southern boundary of the study area have a poor recharge potential. Ground water moves from the eastern part of the reservoir westward toward Monterrey Bay. The amount of usable ground water in storage in the Seaside area in autumn 1979, was estimated to be 730,000 acre-feet. The coastal part of the area from Monterrey Bay inland 1.5 miles has 9,000 acre-feet stores above sea level. The ground-water yield of the coastal part of the area is estimated to range from 2,000 to 3,000 acre-feet per year, and the yield of the total reservoir system is estimated to range from 6,400 to 7,700 acre-feet per year. Ground water in the Seaside area is chemically suitable for most uses; however, dissolved-solids content and hardness are objectionably high for domestic use. Locally, dissolved iron is a problem. Seawater intrusion poses the major threat of water-quality degradation. An observation-well network could be established. Additional geologic and hydrologic exploration would better define the factors that control the storage and movement of ground water. (USGS)
W84-00991

PRELIMINARY EVALUATION OF THE GROUND-WATER-FLOW SYSTEM IN THE TWIN CITIES METROPOLITAN AREA, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
J. H. Guswa, D. I. Siegel, and D. C. Gillies.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-174599, Price codes: A04 in paper copy, A01 in microfiche.
USGS Water Resources Investigations Report 82-44, August 1982. 65 p, 43 Fig, 7 Tab, 19 Ref.

Descriptors: *Hydrologic model, *Hydrologic systems, Groundwater quality, Groundwater, Aquifers, Geologic units, *Minnesota, Twin Cities, *Mississippi River, Minnesota River, St. Croix River.

A preliminary quasi-three-dimensional finite-difference ground-water-flow model of the seven-county Twin Cities Metropolitan area was constructed and used to evaluate parameter sensitivity and adequacy of available data. Fourteen geologic units that underlie the study area were grouped into nine hydrogeologic units and were incorporated into a five-layer model. The layers in the simulation model include the Mount Simon-Hinckley, Ironton-Galesville, Prairie du Chien-Jordan, and St. Peter aquifers and the drift. Sensitivity analyses were made for 19 parameter and boundary-condition specifications. Model results are most sensitive to recharge and withdrawal rates and hydrogeologic variations related to drift-filled bedrock valleys. Analyses of available data and results of steady-state simulations indicate that critical data needs for improving the simulation model include (1) spatial and temporal variations in ground-water withdrawals and potentiometric levels, and (2) hydraulic properties of the drift that fills or partly fills bedrock valleys. Areal distribution of calcium, sodium, sulfate, and chloride concentrations were analyzed to provide information on the hydrologic and geochemical relationships between aquifers. Ground water is generally of the calcium magnesium bicarbonate type. Concentration of dissolved solids in the Jordan Sandstone and Mount Simon-Hinckley aquifer generally decreases from southwest to northeast across the study area. This decrease probably reflects differences in the quality of recharge water and geochemical processes within the aquifers such as ion-exchange. (USGS)
W84-00995

HYDROGEOLOGY OF A LANDFILL OPERATION, PINELLAS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W84-00996

GRAVITY SURVEY OF DIXIE VALLEY, WEST-CENTRAL NEVADA,
Geological Survey, Boise, ID. Water Resources Div.
D. H. Schaefer.
USGS Open-File Report 82-111, 1983. 17 p, 6 Fig, 2 Tab, 16 Ref.

Descriptors: *Gravimetric prospecting, Geophysical prospecting, Dixie Valley, *Nevada, *Alluvial thickness, Geothermal resources.

Dixie Valley, a northeast-trending structural trough typical of valleys in the Basin and Range Province, is filled with a maximum of about 10,000 feet of alluvial and lacustrine deposits, as estimated from residual-gravity measurements obtained in this study. On the basis of gravity measurements at 300 stations on nine east-west profiles, the gravity residuals reach a maximum of 30 milligals near the south-central part of the valley. Results from a three-dimensional inversion model indicate that the central depression of the valley is offset to the west of the geographic axis. This offset is probably due to major faulting along the west side of the valley adjacent to the Stillwater Range. Comparison of depths to bedrock obtained during this study and depths obtained from a previous seismic-refraction study indicates a reasonably good correlation. A heterogeneous distribution of densities within the valley-fill deposits would account for differing depths determined by the two methods. (USGS)
W84-01000

EVALUATION OF WATER-QUALITY CHARACTERISTICS OF PART OF THE SPOKANE AQUIFER, WASHINGTON AND IDAHO, USING A SOLUTE-TRANSPORT DIGITAL MODEL,
Geological Survey, Tacoma, WA. Water Resources Div.
J. J. Vaccaro, and E. L. Bolke.
USGS Water-Resources Investigations Open-File Report 82-769, 1983. 69 p, 26 Fig, 7 Tab, 23 Ref.

Descriptors: Mathematical model, *Groundwater, *Water quality, Chlorides, *Surface/groundwater relationships, Spokane Valley, Spokane River, *Washington, *Idaho.

A digital model was developed and used to simulate solute transport of conservative ions in the Spokane aquifer. The model calculates a solute-flux budget that can be used for management purposes. The model was used specifically to estimate the impact of the chloride ion from septic-tank recharge and from land-surface-applied water on the water quality of the Spokane aquifer. Model analysis showed the estimated impact on the aquifer from these sources to be less than a 1-mg/L increase over about 80% of the aquifer, and about 3 mg/L in some peripheral locations. Other water-quality-management schemes using various man-made or natural stresses can be tested with the model. (USGS)
W84-01001

GEOTHERMAL RESOURCES OF THE WESTERN ARM OF THE BLACK ROCK DESERT, NORTHWESTERN NEVADA--PART I, GEOLOGY AND GEOPHYSICS,
Geological Survey, Boise, ID. Water Resources Div.
D. H. Schaefer, A. H. Welch, and D. K. Maurer.
USGS Open-File Report 81-918, 1983. 37 p, 15 Fig, 3 Tab, 52 Ref.

Descriptors: *Geothermal studies, Gravimetric prospecting, *Geophysical prospecting, Black Rock Desert, *Nevada.

Studies of the geothermal potential of the western arm of the Black Rock Desert in northwestern Nevada included a compilation of existing geologic data on a detailed map, a temperature survey at 1-meter depth, a thermal-scanner survey, and gravity and seismic surveys to determine basin geometry. The temperature survey showed the effects of heating at shallow depths due to rising geothermal fluids near the known hot spring areas. Lower temperatures were noted in areas of probable near-surface ground-water movement. The thermal-scanner survey verified the known geothermal areas and showed relatively high-temperature areas of standing water and ground-water discharge. The upland areas of the desert were found to be distinctly warmer than the playa area, probably due to low thermal diffusivity resulting from low moisture content. The surface geophysical surveys indicated that the maximum thickness of valley-fill deposits in the desert is about 3,200 meters. Gravity data further showed that changes in the trend of the desert axis occurred near thermal areas. (USGS)
W84-01007

AQUIFER SYSTEMS IN THE GREAT BASIN REGION OF NEVADA, UTAH, AND ADJACENT STATES--A STUDY PLAN,
Geological Survey, Boise, ID. Water Resources Div.
J. R. Harrill, A. H. Welch, D. E. Prudic, J. M. Thomas, and R. L. Carman.
USGS Open File Report 82-445, 1983. 49 p, 18 Fig, 39 Ref.

Descriptors: *Aquifer systems, *Regional analysis, Ground water, Geohydrology, Mathematical models, *Great Basin, *Regional aquifer system, *Nevada, *Utah.

The Great Basin Regional Aquifer Study includes about 140,000 square miles in parts of Nevada, Utah, California, Idaho, Oregon, and Arizona within which 240 hydrographic areas occupy structural depressions formed primarily by basin-and-range faulting. The principal aquifers are in basin-fill deposits; however, significant carbonate-rock aquifers underlie much of eastern Nevada and western Utah. In October 1980, the U.S. Geologi-

cal Survey started a 4-year study to: (1) describe the ground-water systems, (2) analyze the changes that have led to the systems' present conditions, (3) tie the results of this and previous studies together in a regional analysis, and (4) provide means by which effects of future ground-water development can be estimated. A plan of work is presented that describes the general approach to be taken. It defines the major tasks necessary to meet objectives and defines constraints on the scope of work. The approach has been influenced by the diverse nature of ground water flow systems and the large number of basins. A detailed appraisal of 240 individual areas would require more resources than are available. Consequently, the general approach is to study selected 'typical' areas and key hydrologic processes. Effort during the first three years will be directed toward describing the regional hydrology, conducting detailed studies of 'type' areas and studying selected hydrologic processes. Effort during the final year will be directed toward developing a regional analysis of results. Special studies will include evaluation of regional geochemistry, regional hydrogeology, recharge, ground-water discharge, and use of remote sensing. Areas to be studied using ground-water flow models include the regional carbonate-rock province in eastern Nevada and western Utah, six valleys--Las Vegas, Carson, Paradise, Dixie, Smith Creek, and Stagecoach--Nevada, plus Jordan Valley, the Millford area, and Tule Valley in Utah. The results will be presented in a series of reports that will summarize findings, hydrologic principles, and techniques that can be applied throughout the Great Basin. (USGS)
W84-01008

HYDROGEOLOGY AND SIMULATION MODEL OF WATER FLOW IN THE KOOTENAI AQUIFER OF THE JUDITH BASIN, CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
J. F. Levings.
USGS Water-Resources Investigations, Report 83-4146, September 1983. 39 p, 15 Fig, 35 Ref.

Descriptors: *Model studies, Computer models, *Groundwater, *Geohydrology, Structural geology, Judith basin, Fergus County, Judith Basin County, *Montana.

Five Jurassic and Cretaceous formations in the Judith basin of central Montana were investigated with a three-dimensional model to improve the understanding of water flow in the Kootenai aquifer. To accomplish this objective, of water flow in the aquifers and two intervening confining layers was constructed from existing data. A steady-state model was calibrated and evaluated using a parameter-estimation procedure. The digital model simulates horizontal flow in the middle (Kootenai) aquifer and vertical leakage through the overlying and underlying confining layers. The top and bottom aquifers are used as constant-head boundaries to aid in simulating vertical leakage. Transmissivity for the aquifer obtained from the calibrated model ranges from 137 to 364 ft super 2/d. Recharge in the form of precipitation on the outcrop is about 2% of total precipitation (5.44 ft super 3/s). The other component of net recharge is 32.48 ft super 3/s of vertical leakage from the Swift aquifer. The cumulative rate of discharge from all known wells completed in the aquifer is about 0.84 ft super 3/s. Other components of net discharge are 1.83 ft super 3/s of underflow and 35.25 ft super 3/s of vertical leakage to the Colorado aquifers. Estimates of vertical hydraulic conductivity are 2.15 x 10- super 2 ft/d for the lower confining layer, and 3.16 x 10- super 3 and 1.33 x 10- super 4 ft/d for the upper confining layer. (USGS)
W84-01009

GEOHYDROLOGY OF THE FRESH-WATER AQUIFER SYSTEM IN THE VICINITY OF OCEAN CITY, MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
J. M. Weigle, and G. Aehmad.
Maryland Geological Survey, Baltimore, Report of Investigations No 37, 1982. 55 p, 29 Fig, 7 Tab, 29 Ref.

Descriptors: *Groundwater movement, *Confined groundwater, *Computer models, Hydrogeology, Aquifers, Groundwater recharge, Groundwater discharge, Potentiometric level, Hydraulic conductivity, Model studies, Saline water, Saline-water intrusion, Sea water, *Inter-aquifer leakage, Cone of depression, Groundwater flow model, Multilayer aquifer model, Quasi three-dimensional model, *Model simulations, Chloride concentration, Vertical leakage, Groundwater withdrawal, Hydraulic stress, Cyclic water-level changes.

Fresh ground water in northeastern Worcester County is restricted to the upper 450 feet of Coastal Plain sediments. Water is available in the Pleistocene water-table aquifer and the Pocomoke, Ocean City, and Manokin artesian aquifers. The sediments, water table, and potentiometric surfaces slope generally east-southeastward. The hydrogeologic structure in the study area continues offshore for at least several miles. Recharge from precipitation in the western part of the area affects all the freshwater aquifers. Under nonpumping conditions, discharge occurs primarily by upward leakage in the eastern part of the area and offshore. Lateral ground-water movement is east-south-eastward. Salty water occurs in the ocean and back bays near Ocean City, and possibly offshore in the Manokin aquifer. Also, at Ocean City some salty water has apparently leaked upward into the basal part of the Manokin aquifer from the underlying St. Marys Formation. Water needs for Ocean City and the nearby mainland are expected to substantially increase and most of this water will probably be withdrawn from the freshwater aquifers underlying the area. Simulation of alternate groundwater development plans with an uncalibrated model indicates that dispersal of pumping centers may spread drawdown cones and may reduce the magnitudes of drawdowns. (USGS)
W84-01011

WATER RESOURCES OF THE SANTA FE RIVER BASIN, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. D. Hunn, and L. D. Slack.
USGS Water-Resources Investigations Report 83-4075, 1983. 105 p, 30 Fig, 9 Tab, 41 Ref.

Descriptors: *Groundwater resources, *Aquifers, *Aquicludes, *Streamflow, *Water quality, Surface-ground-water relationships, Lakes, Springs, Groundwater recharge, Karst, Dissolved solids, Hardness, Sulfates, Low flow, *Santa Fe River Basin, Suwannee basin, *Florida, Floridan aquifer, Surficial aquifer.

The Santa Fe River basin is a 1,384 square-mile area in north-central Florida. The principal source of water is the Floridan aquifer, a sequence of limestone beds, the upper 300 to 800 feet of which contain potable water. The western part of the basin has the greatest potential yields for individual wells, as much as 5,000 gallons per minute, and contains the largest surface-water supplies. Spring discharge and diffuse seepage from the Floridan aquifer augment the Santa Fe River. The Floridan aquifer is overlain by a confining bed that in the western part of the basin is ineffectual. In the eastern part the Floridan aquifer is confined and the confining bed is overlain by a surficial aquifer. The confining bed contains water-yielding zones, which in addition to the surficial aquifer, may supply water for domestic use. Numerous tributary streams supply small amounts of water to the Santa Fe River and its principal tributary, New River. The base flow of most of these streams is supplied by the surficial aquifer. Estimated water use is about 17 million gallons per day, and runoff from the basin is estimated to be 1,400 million gallons per day. (USGS)
W84-01013

IMPACT OF CHANGES IN LAND USE ON THE GROUND-WATER SYSTEM IN THE SEQUIM-DUNGENESS PENINSULA, CLALLAM COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W84-01014

ASSESSMENT OF THE INTERCONNECTION BETWEEN TAMPA BAY AND THE FLORIDAN AQUIFER, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. B. Hutchinson.
Available from National Technical Information Service, Springfield, VA 22161 as ADA-130623, Price codes: A04 in paper copy, A01 in microfiche. USGS Water-Resources Investigations Report 82-54, 1983. 55 p, 23 Fig, 5 Tab, 58 Ref.

Descriptors: *Saline water intrusion, *Computer models, Groundwater movement, Hydrogeology, Dredging, Water management(Applied), Leakage, Floridian aquifer, Tampa Bay, *Florida.

Factors that control interflow between Tampa Bay and the Floridan aquifer are assessed, both qualitatively and quantitatively, with emphasis on the impact of harbor improvement. Hydrogeologic units underlying the 350-square-mile bay include the surficial-sand aquifer, upper sand and clay confining bed, and limestone of the Floridan aquifer. The surficial aquifer and upper confining bed have been eroded away in several areas along the northern coast of the bay to directly expose the Floridan aquifer to saltwater. There also, the top of the aquifer is, has been, or will be exposed to saltwater in numerous channels dredged in the bay. Saltwater-freshwater relations indicate that the degree of bay-aquifer interconnection decreases from north to south. Saltwater intrusion is occurring along the coast of Tampa Bay, as indicated by reduction or reversal of potentiometric-surface gradients and increasing chloride concentrations in coastal monitoring wells. A computer model of ground-water flow developed for a 97-square-mile area was interrogated under five options of channelization and pumping. Model results indicate that the total impact of channelization upon bay-aquifer interconnection are expected to be small and may be imperceptible when considered over the long term with other unknown changes in climate and development. (USGS)
W84-01019

EVALUATION OF THE HYDROLOGIC SYSTEM IN THE NEW LEIPZIG COAL AREA, GRANT AND HETTINGER COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
C. A. Armstrong.
Available from the OFSS, USGS, Lakewood CO 80225, Price: $6.75 in paper copy, $5.00 in microfiche. USGS Open-File Report 82-698, August 1982. 41 p, 16 Fig, 4 Tab, 11 Ref.

Descriptors: *Hydrologic system, *Groundwater, *Aquifers, Transmissivity recharge, Chemical properties, Potential yield, Grant County, Hettinger County, *North Dakota.

Aquifers in the New Leipzig coal area consist of sandstone beds in the Fox Hills Sandstone, the Hell Creek Formation, the Cannonball and Ludlow Members of the Fort Union Formation, and the basal part of the Tongue River Member of the Fort Union Formation. Aquifers also occur in sandstone and lignite beds in the upper part of the Tongue River Member and Sentinel Butte Member of the Fort Union Formation. Potential well yields from each of the aquifers are variable, but are less than 100 gallons per minute. Water in the Fox Hills, Hell Creek, Cannonball, and Ludlow is soft and of the sodium bicarbonate type. Water in basal Tongue River aquifer is either soft or very hard and generally is of the sodium bicarbonate type. Water in the upper Tongue River and Sentinel Butte aquifer system is very hard and generally is either of the calcium bicarbonate or sodium bicarbonate type. There is little or no contribution of ground water to Thirty Mile Creek or the Cannonball River from the area of minable coal. Coal mining will expose sulfide minerals to oxidation,

and result in an increase in dissolved solids and sulfate in water in the basal Tongue River aquifer. (USGS)
W84-01022

HYDROLOGY OF THE BERYL-ENTERPRISE AREA, ESCALANTE DESERT, UTAH, WITH EMPHASIS ON GROUND WATER,
Geological Survey, Salt Lake City, UT. Water Resources Div.
R. W. Mower.
Utah Department of Natural Resources, Salt Lake City, Technical Publication No 73, 1982, 66 p, 32 Fig, 10 Tab, 42 Ref.

Descriptors: *Groundwater recharge, *Groundwater discharge, *Groundwater mining, Underflow, Evapotranspiration, Groundwater models, Beryl-Enterprise area, *Utah, Escalante Desert, Iron County, Washington County.

The Beryl-Enterprise area encompasses 1,920 square miles in southwestern Utah. Water used in the area is supplied by three small streams and a number of wells that tap valley fill. The 1959-78 average annual reported diversions from the streams was 6,500 acre-feet. Withdrawals by wells for irrigation increased from 3,000 acre-feet in 1937 to 92,000 acre-feet in 1974, the maximum ever recorded. In 1977, recharge to the principal ground-water reservoir was an estimated 48,000 acre-feet, but discharge was an estimated 88,000 acre-feet. By 1977, withdrawals had so greatly exceeded recharge that a large depression had formed on the water table in the southern half of the reservoir. In 1978, the ground-water reservoir contained about 72 million acre-feet of water in storage. An analysis by digital-computer model shows that with the 1969-77 pumpage and water-use regimen continuing, water levels will continue to decline to 1992 at a slightly lower rate than they did during 1969-77. (USGS)
W84-01024

WATER RESOURCES OF MANATEE COUNTY FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. P. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-218396, Price codes: A06 in paper copy, A01 in microfiche. USGS Water Resources Investigations Report 81-74, 1983. 112 p, 38 Fig, 19 Tab, 87 Ref.

Descriptors: *Surface water resources, *Groundwater resources, *Water quality, Water utilization, Network design, Aquifers, Manatee County, *Florida, Floridan aquifer.

Rapid development of Manatee County in southwest Florida is creating water-resource problems. This report presents an evaluation of the water resources and potential effects of water-resource developments. Most streams in the county have small drainage basins and minimal flow. Streamflow is variable with the base flow occurring from November to May. The Manattee River and its largest tributary, the Braden River, are the principal sources of public supplies. Surface water is generally of good quality and less mineralized than ground water except in the tidally affected and coastal area. The principal aquifers in the county are the surficial, minor artesian, and the Floridan. The Floridan aquifer is the major source of irrigation water in the county. The minor artesian aquifer is a highly developed source of water for small rural supplies. Withdrawals of 20 to 50 million gallons per fay from the Floridan aquifer since the 1950's have caused declines in the potentiometric surface of about 20 to 50 feet. The quality of ground water is good except in the coastal and southern parts of the county. Water in the Floridan aquifer is generally more mineralized than the other aquifers, generally increasing in mineral content with depth and from the northeast towards the southwest. (USGS)
W84-01026

HYDROGEOLOGY OF THE PROVIDENCE AQUIFER OF SOUTHWEST GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
J. S. Clarke, E. Faye, and R. Brooks.
Georgia Department of Natural Resources, Atlanta, Hydrologic Atlas No 11, 1983. 49 p, 16 Fig, 5 Tab, 25 Ref.

Descriptors: *Georgia, *Hydrogeology, Subsurface mapping, Groundwater, *Aquifer characteristics, *Potentiometric level, Groundwater, *Aquifer characteristics, *Potentiometric level, Groundwater recharge, Leakage, Groundwater movement, Groundwater divide, Water-level fluctuations, Chemical analysis, Water use, Well drilling, Upper cretaceous, Lower tertiary, Chattahoochee River, Flint River, Ocmulgee River, Providence Aquifer.

The predominantly sand Providence aquifer lies within the Coastal Plain physiographic province of southwest Georgia and ranges in thickness from 38 to 386 feet. Estimated transmissivities range from 760 feet squared per day in Schley County to 4,600 feet squared per day in Clay County. Recharge water enters the aquifer in the eastward trending outcrop belt and flow southward, bounded by the Ocmulgee River on the east and the Chattahoochee River on the west. Additional recharge is received through leakage from underlying units. Ground water is discharged from the aquifer to streams both in the outcrop area and downdip through overlying units. Idle multiaquifer wells in Albany and Dawson provide conduits for upward discharge of water from the Providence aquifer. (USGS)
W84-01031

EFFECTS OF GROUND-WATER DEVELOPMENT IN THE NORTH FORT HOOD AREA, CORYELL COUNTY, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
W. M. Sandeen.
USGS Water-Resourses Investigations Report 83-4074, 1983. 49 p, 5 Fig, 8 Tab, 9 Ref.

Descriptors: *Groundwater, *Texas, Fort Hood, Coryell County, *Groundwater withdrawals, *Water-level declines, Slightly saline water.

Nearly all ground water in the North Fort Hood area, located in Coryell County in central Texas, is withdrawn from the Hensell and Hosston Members of the Travis Peak Formation. The total average annual rates of ground-water withdrawals, mostly for public supply, has steadily increased from nearly 0.5 million gallons per day during 1955 to more than 1.5 million gallons per day during 1980. The principal effect of the long-term development of ground water in the area has been a large decline of water levels in wells. The historical confined (artesian) conditions of the principal aquifer have changed to water-table conditions in some areas as the artesian head drops below the base of the confining layer due to pumping. The greater storage property of the unconfined system will decrease the rate of water-level declines. However, well yields will continue to decrease in relation to the general decline of hydraulic head in the aquifer. The ground water in the area is slightly saline with the concentrations of some constituents generally exceeding chemical-quality limits set by the U.S. Environmental Protection Agency for public-water supplies. The historical chemical changes in the ground water generally are insignificant and appear unrelated to the large declines of water levels of the area. (USGS)
W84-01032

RESULTS OF HYDRAULIC TESTS IN U.S. DEPARTMENT OF ENERGY'S WELLS DOE-4, 5, 6, 7, 8 AND 9, SALT VALLEY, GRAND COUNTY, UTAH,
Geological Survey, Denver, CO. Water Resources Div.
L. E. Wollitz, W. Thordarson, M. S. Whitfield, Jr., and J. E. Weir, Jr.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $10.00 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-346, 1982. 71 p, 33 Fig, 15 Tab, 19 Ref.

Descriptors: *Aquifer tests, *Hydraulic conductivity, *Transmissivity, Drawdown curves, Recovery curves, Saline groundwater, Salts, Radioactive dating, *Utah, Water wells, Paradox Member, Hermosa Formation, *Salt Valley Anticline, Paradox basin, Grand County.

Six exploratory wells, were drilled into the cap rock underlying Salt Valley, Utah, for geologic, geophysical, and hydrologic data to augment information obtained from three previous test wells. Drilling of three other test holes was abandoned before reaching the zone of saturation; the upper 100 meters of cap rock is unsaturated. Within the saturated part of the cap rock, hydraulic heads generally decrease with depth and to the northwest in this part of the valley. Hydraulic conductivity of the cap rock, as determined from pumping tests, ranged from 0.000093 to 0.206 meters per day; as a result, natural ground-water flow rates in the cap rock are small. Water ranges from a calcium bicarbonate sulfate type on the western edge of the valley to a calcium magnesium sodium bicarbonate, sulfate, chloride type near the center of the valley. Carbon-14 specific activity for cap-rock water yielded an uncorrected age of about 17,000 to 26,000 years before present near the western edge of the valley and about 1,000 years before present near the center of the valley. (USGS)
W84-01039

GROUND-WATER RESOURCES OF RANSOM AND SARGENT COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
C. A. Armstrong.
North Dakota Geological Survey, Bismarck, Bulletin 69, 1982. 51 p, 14 Fig, 3 Tab, 48 Ref.

Descriptors: *Water resources, *Ground water, *Aquifers, Transmissivity, Recharge, Water use, Chemical properties, Potential yield, Ransom County, Sargent County, *North Dakota.

Ground water in Ransom and Sargent Counties is available from the Dakota aquifer system of Cretaceous age and from aquifers in the glacial drift and alluvial aquifers Quaternary age. The Dakota aquifer system has a greater areal extent, but aquifers in the glacial drift provide a greater yield to individual wells. The Dakota aquifer system generally yields less tha 50 gallons per minute to wells. The water ranges from soft to very hard and is a sodium sulfate or sodium chloride type. Glacial-drift aquifers consist of sand and gravel deposits in buried valleys and glacioaqueous deposits in Ransom and Sargent Counties. These aquifers underlie about 690 square miles and contain an estimated 3,000,000 acre-feet of available ground water. Potential well yields range from 50 to 1,500 gallons per minute. The water generally is hard and is a calcium or sodium bicarbonate type. The rural population and all communities in Ransom and Sargent Counties depend on ground water as their source of supply. (USGS)
W84-01050

2G. Water In Soils

MATHEMATICAL MODELS OF SOIL MOISTURE PROFILES USING TWO-PHASE FLOW THEORY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
H. J. Morel-Seytoux.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140599, Price codes: A04 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute Completion Report No 127, Colorado State Univ., Fort Collins, July 1983. 58 p, 3 Fig, 1 Tab, 5 Ref. OWRT B-207-COLO(1), 14-34-0001-0260.

Descriptors: *Model studies, *Mathematical studies, *Finite difference methods, *Soil water, *Infiltration, *Soil moisture profiles, Two-phase flow theory.

Three methods of analysis for prediction of infiltration and water content profiles in a soil column are

presented. The first method is the more or less classical finite difference approach except that the governing equations are those deduced from two-phase flow theory. As a result the determination of the water content at the soil surface before ponding is facilitated. Similarly, after ponding the calculation of the capacity infiltration rate is more stable than with the usual finite difference approximations to Richard's equation. The second method is purely analytical. It 'speaks' as results such as ponding time are obtained explicitly in terms of the various parameters of the problem (hydraulic conductivity, effective capillary drive, initial water content, etc.). Each solution applies for a particular value of the exponent n in the power law form of the relative permeability vs. normalized water content carve. Solutions have been obtained for n = 1,2,3,4,6 and 8. Profiles look realistic. Nevertheless, the results are approximate. A third method, a hybrid method, tries to combine the advantages of the numerical and analytical techniques by retaining the versatility of the numerical method and the low cost of the analytical method. The hybrid method is illustrated in depth for the case n = 1. The case n = 2 has been discussed previously in the literature (Morel-Seytoux, 1982). Results for the case n = 4 are given without derivation. The case n = 4 has been implemented operationally in a computer program SOILMOP. Tests (though limited) indicate that accuracy with SOILMOP is comparable with existing difference code for the Richar's equation and is 25 times cheaper. The hybrid technique appears to have a significant potential.
W84-00966

HYDRAULIC CONSIDERATIONS IN SAMPLING THE UNSATURATED ZONE WITH INCLINED GRAVITY LYSIMETERS,
Geological Survey, Albany, NY. Water Resources Div.
E. T. Oaksford.
USGS Water-Resources Investigations Report 83-4005, 1983. 17 p, 12 Fig, 9 Ref.

Descriptors: *Gravity lysimeters, *Water sampling, *Unsaturated zone, *Soil water, Suffolk County, Long Island, *New York.

Inclined gravity lysimeters as deep as 5.39 meters below land surface designed for sampling soil water in coarse sand under continuous ponding conditions, were shown to be capable of collecting 10 liters per hour at an infiltration rate of 0.5 meter per hour. This represents a capture efficiency of approximately 50%, a value observed in two similar but shallower lysimeters. When lysimeters are installed from a trench or observation manhole, soil-water samples can be taken under virtually undisturbed conditions, avoiding the soil disturbance and filtration associated with porous-cup vacuum lysimeters. Successful operation requires that the sampler be designed for the hydraulic characteristics of the soil from which the water sample is to be extracted. Criteria for lysimeter dimensions can be established on the basis of pressure heads experienced during sampling, can be induced to flow into the lysimeter by gradient manipulation. Observed head gradients outside the lysimeter ranged between 1.7 and 2.2 times those across the lysimeter, which would seem to explain the observed capture efficiency. (USGS)
W84-01018

2H. Lakes

LIMNOLOGICAL CHARACTERISTICS OF WISCONSIN LAKES,
Wisconsin Dept. of Natural Resources, Madison.
R. A. Lillie, and J. W. Mason.
Technical Bulletin No 138, 1983. 116 p, 84 Fig, 43 Tab, 184 Ref, 2 Append.

Descriptors: *Lakes, *Limnology, *Lake morphometry, *Chemical analysis, *Trophic level, *Water quality, Water sampling, Thermal stratification, Chlorophyll A, Macrophytes, Alkalinity, Phosphorus, Nutrients, Secchi disks, Chlorides, Cations, Sulfates, Nitrogen, Water quality management, *Wisconsin.

A 14-year study of Wisconsin lakes began in 1966 when the Wisconsin Legislature recognized the need for data on the state's water resources. This report is intended as a technical reference for professionals in water-related fields. A random selection of 1,140, or 25% of Wisconsin lakes, all greater than 5 feet deep and 25 acres in size, comprised the data base. Water samples were collected and subjected to physical, chemical and biological analyses. These results, with field notes and known morphometric characteristics, formed the core of the data used in the study. The data allowed the evaluation and examination of general limnological characteristics of Wisconsin lakes. An apparent water quality index is presented for Wisconsin lakes, incorporating water clarity, chlorophyll concentration, and total phosphorus. Preferably, all three parameters should be used in evaluating a lake. Strong relationships exist between a great number of measured physical, chemical, and biological parameters. On the other hand, a considerable amount of scatter occurs in plots of the various interrelationships, which suggests that caution must be used in applying linear regression formulae derived from these associations for predictive purposes. Assessment of trends in water quality is restricted by insufficient data. The substantial amount of individual lake data collected and analyzed should be useful as a historical data base for evaluating future trends in water quality for sampled lakes. (Fazio-Omniplan)
W84-00794

COMPUTER SIMULATION OF PHOSPHORUS CYCLING IN THE SEDIMENT-WATER SYSTEM OF EUTROPHIC LAKES,
Maine Univ. at Orono. Dept. of Mathematics.
T. A. Hannula, and C. A. Rock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140573, Price codes: A08 in paper copy, A01 in microfiche. Land and Water Resources Center Completion Report, August 1983. 156 p, 38 Fig, 8 Tab, 19 Ref, 1 Append. OWRT B-021-ME(1), 14-34-0001-1231.

Descriptors: *Computer models, *Cycling nutrients, *Diagenesis, *Lake sediments, *Phosphorus, Adsorption, Anaerobic conditions, Boundary conditions, Decomposing organic matter, Diffusion coefficient, Eutrophic lakes, Interstitial water, Mathematical models, Porosity, Radioactive dating, Recycling, Seasonal Variation, Vertical Distribution, *Maine, Lake Sebasticook.

It has become increasingly evident that the release of phosphorus from the sediments of eutrophic lakes is a major factor in the excessive productivity of these lakes. Using the diagenic partial differential equations which model the sediment processes of lakes and oceans, a computer simulation model has been developed to study the P dynamics in lake sediments. The model allows both time and depth variation of the key equation parameters. The model clearly shows that the upper 10 cm of sediment is the main region of activity. The lowering of the sorption coefficient and PIW increase are the most significant factors in a large summer P release from the sediment. The rapid burial and decomposition of organic matter in the top few centimeters of sediment in these productive lakes is sufficient to maintain the pore water and sorbed P at levels needed to support a large summer P release. The model generates summary tables and 3D plots of key variables over a year's simulation. The Numerical Method of Lines is used to solve the model equations. Data from L. Sebasticook, Newport, Maine are used to test the model.
W84-00964

HYDROLOGY OF WISCONSIN, WETLANDS,
Geological Survey, Albany, NY. Water Resources Div.
R. P. Novitzki.
University of Wisconsin-Extension, Madison, Geological and Natural History Survey, Information Circular No 40, 1982. 22 p, 14 Fig, 7 Tab, 34 Ref.

Descriptors: *Wetlands, Floods, Base flow, Sediment yield, *Wisconsin wetlands, *Hydrologic wetlands classification.

The hydrologic characteristics of Wisconsin's wetlands, and their effect on floodflows and base flows, are described. Wetlands occur in depression and on slopes, and may be in contact with ground water or totally surface-water supported. Wisconsin's wetlands can be classified as surface-water depression, ground-water depression, surface-water slope, or ground-water slope. Throughout the State, floodflows are 80% lower, springtime streamflows 40% higher, and fall base flows 40% lower in basin with 40% lake and wetland area than in basins with no lake and wetland area. In the north-central third of the State sediment yields are 90% lower in basins with 40% lake and wetland area. (USGS)
W84-00998

GENERAL HYDROLOGY AND EXTERNAL SOURCES OF NUTRIENTS AFFECTING PINE LAKE, KING COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
N. P. Dion, S. S. Sumioka, and T. C. Winter.
USGS Water-Resources Investigations Report 83-4057, 1983. 29 p, 10 Fig, 3 Tab, 25 Ref.

Descriptors: *Lakes, *Hydrologic budget, *Nutrients, *Water pollution sources, *Washington, King County, Pine Lake, Lake restoration.

An adjusted water budget prepared for Pine Lake, a candidate for lake-quality restoration, indicates that of approximately 790 acre-feet of water that enters the lake in a typical year, 410 acre-feet is from precipitation, 350 acre-feet is from surface inflow, and 30 acre-feet is from ground-water seepage. A nearly equal amount of water leaves the lake and of this, 130 acre-feet is by evaporation, 659 acre-feet is by surface runoff, and less than one acre-foot is by ground-water seepage. Based on these amounts of inflow and outflow, the theoretical water-renewal time of the lake is calculated to be 2.2 years. The contributions of inorganic nitrogen and phosphorus to the lake in a typical year from precipitation, surface inflow, and groundwater inflow is about 2,500 pounds of nitrogen and 49 pounds of phosphorus. (USGS)
W84-01015

WATER-QUALITY ASSESSMENT OF FRANCIS E. WALTER RESERVOIR, LUZERNE AND CARBON COUNTIES, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. L. Barker.
USGS Water-Resources Investigations Report 83-4032, June 1983. 51 p, 14 Fig, 17 Tab, 24 Ref.

Descriptors: *Water quality, *Limnology, *Nutrients, Physical properties, Biological properties, Chemical properties, Stratification, Luzerne County, Carbon County, Data collection, Francis E. Walter Reservoir, *Pennsylvania.

Water-quality data, both past and present, show that the waters of the upper Lehigh River basin are somewhat acidic, but otherwise are generally of good quality. This report is a summary of all known water-quality data collected by the U.S. Geological Survey and other agencies, includes a synopsis of current water-quality conditions in the reservoir and its tributaries. Data collected from June 1981 to May 1982 indicate that raising the pool an additional 92 feet had some significant, if only temporary, detrimental effects on the reservoir system. Depth profile measurements show that the dissolved oxygen concentrations were depressed to near-aquifer levels, and the median pH values were depressed from 6.5 to 6.0. (USGS)
W84-01029

2I. Water In Plants

WETLAND HYDROLOGY AND TREE DISTRIBUTION OF THE APALACHICOLA RIVER FLOOD PLAIN, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. M. Leitman, J. E. Sohm, and M. A. Franklin.

Available from the Eastern Distribution Br. USGS, 604 S. Pickett St. Alexandria, VA 22304. USGS Water-Supply Paper 2196-A, 1983. 52 p, 39 Fig, 14 Tab, 70 Ref.

Descriptors: *Wetlands, *Trees, *Distribution patterns, *Flood plains, Soil water, Forests, Hardwood, River basins, Flood stages, Flow duration, Levees, Surface water, Water level, *Florida, Apalachicola River.

The Apalachicola River is part of a 50,800-square-kilometer drainage basin in northwest Florida, Alabama, and Georgia. The river is formed by the confluence of the Chattahoochee and Flint Rivers at Jim Woodruff Dam and flows 171 kilometers to Apalachicola Bay in the Gulf of Mexico. Its flood plain supports 450 square kilometers of bottomland hardwoods and tupelo-cypress forests. The most common trees, constituting 62% of the total basal area, were five wet-site species; water tupelo, Ogeeche tupelo, baldcypress, Carolina ash, and swamp tupelo. Other common species were sweetgum, overcup oak, planertree, green ash, water hickory, sugarberry, and diamond-leaf oak. Five forest types were defined based on species predominance by basal area. Biomass increased downstream and was greatest in forests growing on permanently saturated soils. Water and tree relations varied with river location because range in water-level fluctuation and topographic relief in the flood plain diminshed downstream. Heights of natural riverbank levees and size and distribution of breaks in levees had a major controlling effect on flood-plain hydrology. Depth of water, duration of inundation and saturation, and river location, but not velocity, were very highly correlated with forecast types. (USGS)
W84-00813

2J. Erosion and Sedimentation

STREAMFLOW AND SUSPENDED-SEDIMENT TRANSPORT IN GARVIN BROOK, WINONA COUNTY, SOUTHEASTERN MINNESOTA HYDROLOGIC DATA FOR 1982,
Geological Survey, St. Paul, MN. Water Resources Div.
G. A. Payne.
USGS Open-File Report 83-212, March 1983. 22 p, 4 Fig, 7 Tab, 6 Ref.

Descriptors: *Sediment discharge, *Sediment load, *Streamflow, *Particle size, Small watersheds, Demonstration watersheds, Soil conservation, *Minnesota, Winona County.

Streamflow and suspended-sediment-transport data were collected in Garvin Brood watershed in Winona County, Southeastern Minnesota, during 1982. The data collection was part of a study to determine the effectiveness of agricultural best-management practices designed to improve rural water quality. The study is part of a Rural Clean Water Program demonstration project undertaken by the U.S. Department of Agriculture. Continuous streamflow data were collected at three gaging stations during March through September 1982. Suspended-sediment samples were collected at two of the gaging stations. Samples were collected manually at weekly intervals. During periods of rapidly changing stage, samples were collected at 30-minute to 12-hour intervals by stage-activated automatic samplers. The samplers were analyzed for suspended-sediment concentration and particle-size distribution. Particle-size distributions were also determined for one set of bed-material samples collected at each sediment-sampling site. The streamflow and suspended-sediment-concentration data were used to computer records of mean-daily flow, mean-daily suspended-sediment concentration, and daily suspended-sediment discharge. The daily records are documented and results of analyses for particle-size distribution and of vertical sampling in the stream cross sections are given. (USGS)
W84-00832

SUBBASIN 12, LOWER JUNIATA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6D.
W84-00842

STREAMFLOW AND SEDIMENT TRANSPORT IN THE QUILLAYUTE RIVER BASIN, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
L. M. Nelson.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $4.25 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-627, 1982. 29 p, 11 Fig, 7 Tab, 19 Ref.

Descriptors: *Sediment, Sediment transport, *Sediment yield, Bedloads, *Low flows, Streamflows, Land use, Jefferson County, Clallam County, Quillayute River, *Washington.

From October 1976 to September 1978 the U.S. Geological Survey made a reconnaissance evaluation of the fluvial-sediment transport and documented the natural streamflow characteristics in the Quillayute River basin in northwestern Washington. Most of the flow originates from the tributaries, the Soleduck, Bogachiel, and Calawah Rivers. Flow in the summer months from the Calawah River is about half that from either the Bogachiel or Soleduck Rivers. In the winter months flow from the Soleduck River is about 1 1/2 times that of the Bogachiel or Calawah Rivers. In general, the highest monthly flows during the winter are about 10 times greater than the lowest monthly flows during the summer except for the Dickey River where winter flows are about 20 times greater. Annual mean discharges may vary greatly from year to year, ranging from about 1/2 to 1 1/2 times the mean annual discharge. For the study period, the observed suspended-sediment concentration ranged from less than 1 to 2,150 milligrams per liter. The estimated mean annual suspended-sediment discharges were: Bogachiel River--400,000 tons (includes Calawah River); Calawah River--120,000 tons; Soleduck River--120,000 tons; Dickey River--75,000 tons; and other tributaries--10,000 tons, for a total of 606,000 tons transported annually by the Quillayute River. The estimated annual bedload of 21,000 tons was transported into the Quillayute River by the Soleduck, Bogachiel, and Dickey Rivers. (USGS)
W84-00920

FIELD DATA DESCRIBING THE MOVEMENT AND STORAGE OF SEDIMENT IN THE EAST FORK RIVER, WYOMING: PART III. RIVER HYDRAULICS AND SEDIMENT TRANSPORT, 1980,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00937

AN EVALUATION OF SUSPENDED SEDIMENT AND TURBIDITY IN COW CREEK, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
D. A. Curtiss.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $3.25 in paper copy, $3.50 in microfiche. USGS Water Resources Investigations Open-File Report 82-364, 1982. 21 p, 11 Fig, 4 Tab, 9 Ref.

Descriptors: *Sediments, *Sediment transport, *Turbidity, Fluvial sediments, Sediment distribution, Settling velocity, *Residual turbidity, *Clay transport, *Oregon, Douglas County, Cow Creek.

During a 6-month period from December 1980 through May 1981, samples were collected from Cow Creek near Azalea, Oregon, and analyzed for suspended sediment, particle-size distribution, and turbidity. Of the estimated suspended-sediment discharge of 4,270 tons for the 1981 water year, 95% (4,050 tons) was transported during a major storm event December 2-4, 1980. The 1981 water year suspended-sediment discharge of 4,270 tons is well below the average annual suspended-sediment discharge of 22,000 tons reported earlier by Curtiss. A clay-sediment transport curve was used in conjunction with the flow-duration curve to estimate average annual clay discharge of 3,700 tons for Cow Creek near Azalea. Turbidity in Cow Creek near Azalea is estimated to be equal to or less than 15 NTU (nephelometric turbidity units) 90% of the time. A method for predicting turbidity values in a hypothetical impoundment is presented in this report. This method utilizes a suspended-sediment transport curve of the fine material (<0.002 mm) and measure residual-turbidity values. (USGS)
W84-00939

MINERALOGY OF FINE-GRAINED ALLUVIUM FROM BOREHOLE U11G, EXPL. 1, NORTHERN FRENCHMAN FLAT AREA, NEVADA TEST SITE,
Geological Survey, Reston, VA. Water Resources Div.
B. F. Jones.
USGS Open-File Report 82-765, 1982. 10 p, 1 Fig, 3 Tab, 12 Ref.

Descriptors: *Mineralogy, *Clays, *Zeolites, *Alluvium, Water table, Hydration reactions, Weathering, Volcanic glass, Chemical analyses, *Nevada, Frenchman Flat, Smectite, Sepiolite, Interstratified minerals.

The mineralogy of matrix fines in alluvium from borehole Ullg, expl. 1, north of Frenchman Flat, Nevada Test Site, has been examined for evidence of past variations in water table elevation. Although greater abundance of zeolite and slightly more expanded basal spacings in smectite clays suggest effects of increased hydration of material up to 50 m above the present water table, these differences might also be related to provenance of environment of deposition. The relative uniformity of clay hydration properties in the 50 meters above the current water table suggest long-term stability near the present level. (USGS)
W84-00946

MICROCOMPUTER COMPUTATION OF WATER QUALITY DISCHARGES,
Geological Survey, Columbus, OH. Water Resources Div.
D. R. Helsel.
USGS Open-File Report 82-901, 1983. 48 p, 7 Fig, 2 Tab, 2 Ref.

Descriptors: *Computer programs, *Water quality, *Sediment discharge, Hydrographs, Suspended land.

A fully prompted program (SEDQ) has been developed to calculate daily and instantaneous water quality (QW) discharges. It is written in a version of BASIC, and requires inputs of gage heights, discharge rating curve, shifts, and water quality concentration information. Concentration plots may be modified interactively using the display screen. Semi-logarithmic plots of concentration and water quality discharge are output to the display screen, and optionally to plotters. A summary table of data is also output. SEDQ could be a model program for micro and minicomputer systems likely to be in use within the Water Resources Division, USGS, in the near future. The daily discharge-weighted mean concentration is one output from SEDQ. It is defined in this report, differentiated from the currently used mean concentration, and designated the 'equivalent concentration.' (USGS)
W84-00985

SEDIMENT AND STREAM-VELOCITY DATA FOR THE SACRAMENTO RIVER NEAR HOOD, CALIFORNIA, MAY 1978 TO SEPTEMBER 1981,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-01003

EROSION AND SEDIMENT CHARACTERISTICS OF THE SOUTHEASTERN UINTA BASIN, UTAH AND COLORADO,

Geological Survey, Salt Lake City, UT. Water Resources Div.
R. L. Seiler, and J. E. Tooley.
USGS Water-Resources Investigations Open-File Report 82-428, 1982. 44 p, 22 Fig, 10 Tab, 37 Ref.

Descriptors: *Sediment discharge, *Oil shale, *Utah, *Colorado, *Sediment yield, Channel erosion, Deposition, Particle size, Gully erosion, Unita Basin, White River, Source area sediment yield.

This report is part of a series describing the hydrologic characteristics of the southeastern Uinta Basin of Utah and Colorado, area of about 3,000 square miles. The mean annual suspended-sediment discharge of the White River at its mouth near Ouray (1975-79) was 1,759,000 tons (1,150 acre-feet) and for the White River near Colorado-Utah state line (1977-79) sediment discharge was 1,031,000 tons (675 acre-feet). The total-sediment yield for the area between these two stations for the period of concurrent record is calculated to be about 900 tons (0.59 acre-foot) per square mile per year. During snowmelt runoff from the lower basin (March) and later during snowmelt runoff from the upper basin (May and June) there are periods of large, sustained sediment discharges in the White River. During late summer, sediment discharge can increase significantly in response to thunderstorm runoff from normally dry tributaries. Large amounts of bed material are scoured from the lower White River channel during the annual peak flow, however, the mean streambed altitude does not change much because an equivalent amount of material is deposited in the channel during peak flow recession. (USGS)
W84-01036

WATER-QUALITY AND FLUVIAL-SEDIMENT CHARACTERISTICS OF SELECTED STREAMS IN NORTHEAST KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
H. E. Bevans.
USGS Water Resources Investigations Report 82-4005, 1982. 53 p, 2 Fig, 15 Tab, 17 Ref.

Descriptors: *Agricultural watersheds, *Water analysis, *Suspended sediments, *Chemical analysis, Sediment discharge, Sediment concentration, Streamflow, Statistical analysis, *Kansas.

In cooperation with the U.S. Soil Conservation Service, an investigation was made of the water-quality and fluvial-sediment characteristics of selected streams in northeast Kansas for which the construction of floodwater-retarding and grade-stabilization structures to control soil erosion is being considered. The predominent chemical type of water in streams draining the study area is calcium bicarbonate. In-stream concentrations of chemical constituents generally decrease with increasing streamflow. Exceptions to this are nitrate and phosphorus, which enter the streams as components of surface runoff. Computed mean annual discharges of dissolved solids ranged from 512 tons for Pony CratkSabetha, Kansas, to 23,900 tons for the Wolf River near Sparks, Kansas. Sediment yields in the study area, predominently silt and clay, are among the largest in the State. Drainage basins in the northern part of the study area yielded the most suspended sediment, with Pony Creek at Sabetha and near Reserve, Kansas, yielding 5,100 tons per square mile per year. Drainage basins in the southern part of the study area yielded less suspended sediment, with Little Grasshopper Creek near Effingham, Kansas, yielding 493 tons per square mile per year and Little Delaware River near Horton, Kansas, yielding 557 tons per square mile per year. (USGS)
W84-01045

2K. Chemical Processes

HYDROGEOCHEMICAL CYCLING IN A WATERSHED-GROUNDWATER SYSTEM: FORT RIVER AND CADWELL CREEK, MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
For primary bibliographic entry see Field 5B.
W84-00967

2L. Estuaries

HYDROGEOCHEMISTRY OF THE NEW JERSEY PINE BARRENS,
Battelle Columbus Div., OH.
For primary bibliographic entry see Field 5B.
W84-00793

WATER QUALITY OF THE BARATARIA MARSH UNIT, JEAN LAFITTE NATIONAL HISTORIC PARK, LOUISIANA (APRIL 1981-MARCH 1982),
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00900

LITERATURE ASSESSMENT OF THE CHARLOTTE HARBOR ESTUARINE SYSTEM AND SURROUNDING AREA, SOUTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 10C.
W84-00992

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

UTILIZATION OF THE NEW MINERAL UF MEMBRANES FOR MAKING SEMI-HARD CHEESES,
Institut National de la Recherche Agronomique, Rennes (France). Dairy Technology Research Lab.
H. Goudedranche, J. L. Maubois, P. Ducruet, and M. Mahaut.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 243-258, 3 Tab, 8 Fig, 14 Ref.

Descriptors: *Membranes, Mineral membranes, *Ultrafiltration, *Cheese, Milk.

By using an ultrafiltration (UF) apparatus equipped with new mineral membranes making it possible to reach a protein content of 21% and a T.S. Content of 45%, making semi-hard cheese such as the French variety St. Paulin was studied. Properties of precheeses were characterized for defining optimum parameters of the proposed process. Acidification, addition of salt, renneting pH, and temperature were studied for their influence regarding the rheological behavior of the precheese and/or the organoleptic qualities of young and ripened cheese. Advantages of the process (increase of 19% of the cheese yield, no in-vat processing, possible addition of flavouring substances) are discussed. Performances observed with the new UF equipment (30 l of milk treated per hour per sq m) and its cleanability offer sufficient reliability to envisage an industrial scale up.
W84-00701

MEMBRANE PROCESSES FOR WATER, PULP AND PAPER, FOOD. STATE OF THE ART,
Alfa-Laval A.B., Tumba (Sweden).
R. Glimenius.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 259-272, 2 Diag.

Descriptors: *Membranes, Electrodialysis, Reverse osmosis, Ultrafiltration, *Desalination, *Pulp and paper industry, *Food industry, History, Economics, Reviews.

General trends, are presented on membrane processes for the water, pulp and paper, and the food industry. Thus electrodialysis, reverse osmosis and ultrafiltration are considered from their historic and economic aspects, and thoughts are advanced on how and why institutions and companies have entered this technology and which entities will be leading the development in the eighties.
W84-00702

CONCEPTUAL DESIGN ASPECTS OF REVERSE OSMOSIS,
Envirogenics Systems Europe, Leiden (Netherlands).
D. Kuiper, and M. Mendia.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 273-289, 3 Tab, 5 Fig.

Descriptors: *Reverse osmosis, Process design, Costs, *Membranes, Desalination, Fouling, Pretreatment.

The reverse osmosis process is used for a variety of different applications. As a result the design of the installations shows marked differences which are reflected in the cost of the process. The most relevant process variables are described in relation to the process design and cost. These are the effect of pressure, feed quality, membrane configuration, membrane fouling and pretreatment. The properties of new membranes are discussed in view of process applicability, possible improvements, and cost reductions.
W84-00703

MEMBRANE TECHNOLOGY IN THE PULP AND PAPER INDUSTRY,
O. Olsen.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 291-302, 15 Fig, 11 Ref.

Descriptors: *Reserve osmosis system, *Membrane technology, Membrane filtration, *Pulp and paper industry, Lignosulphonate recovery, Lignin recovery, Plate-and-frame membranes.

Membrane filtration is an industrial process in the pulp and paper industry. The rising demand for environmental protection, energy savings and recovery of valuable products has accelerated the application of membrane filtration. The most important applications in the pulp and paper industry are: (1) Recovery of valuable products - Fractionation and purification of lignosulphonate from spent sulphite liquor; fractionation and purification of lignin from kraft black liquor. (2) Energy savings - Concentration of dilute spent sulphite by membrane filtration requiring lessenergy than evaporation. (3) Environmental protection - Purification of effluents from kraft bleach effluent. The DDS RO-system is a plate-and-frame system. DDS started the development of membrane filtration in the pulp and paper industry in 1971, and the first plant was installed in 1973.
W84-00704

ULTRAFILTRATION OF EFFLUENTS FROM SLAUGHTERHOUSES AND BRINE IN THE MEAT INDUSTRY,
M. Goldberg.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 303-315, 2 Tab, 7 Fig, 17 Ref.

Descriptors: *Ultrafiltration, Brines, *Meat processing industry, Slaughterhouses, Protein, *Plasma, *Cruorin.

Ultrafiltration, when an integral part of an effluent processing system, makes it possbile to valorize this effluent and assist in depollution. Ultrafiltration of plasma from slaughterhouses is discussed which enables recovery of proteins. The daily production of proteins (plasma and cruorin) can be

estimated at approximately 60 tons. As to the brine effluent, this can be treated in order to concentrate the proteins and diminish the salt concentration.
W84-00705

APPLICATION OF SELECTIVE MEMBRANES IN GRAPE JUICE STABILIZATION,
Belgrade Univ. (Yugoslavia). Faculty of Agriculture.
G. Niketic-Aleksic, and M. M. Jaksic.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 317-327, 1 Tab, 6 Fig, 19 Ref.

Descriptors: *Membranes, *Electrodialysis, Food processing industry, *Grape juice, Potassium tartrate.

An electrodialytic membrane separation procedure for grape juice stabilization from potassium tartrate precipitation was investigated. The most promising processing was achieved by cationic membrane pairs, particularly with DuPont's Teflon-based Nafion 390. Potassium ions were removed below their critical content defined by the solubility product with tartrate ions, while the acidity remained within tolerable limits. The separation process follows Faraday's law of electrolysis down to the final exhaustion of potassium ions thereby providing directly the contact time for the stabilization. At the same time it represents a new economical mean to drastically reduce potassium ion content in smaller amount of juice and further to adjust the final composition by mixing it with larger quantities of raw material. Cationic-anionic membrane pairs for both potassium and tartrate ionic separation were also tried. The effect of electrodialytic separation on grape juice composition and stability was investigated.
W84-00706

MEMBRANE TECHNOLOGY AND BIOTECHNOLOGY,
Stanford Univ., CA.
A. S. Michaels.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 329-351, 18 Fig.

Descriptors: *Membranes, Biotechnology, *Reverse osmosis, *Ultrafiltration, Fermentation, *Biochemistry, Reviews.

Membrane and membrane-separation technology is finding increasing attention as a means for culturing microorganisms, recovering and isolating costly labile products, and disposing of objectionable toxic wastes. Continuous crossflow filtration with microporous or ultrafiltration membranes is being used to separate cells from supernatant in whole fermentation broths with high product recovery, and elimination of a major waste-disposal problem. Reverse osmosis and ultrafiltration are receiving attention for concentrating fermentation liquors to facilitate final product recovery, or for demineralizing or removing colloidal impurities from product-containing solutions to improve product yield and purity. Hollow-fiber membrane devices serve as excellent 'artificial capillary beds' for the maintenance of mammalian cell cultures; used as artificial organs, and for the production of hormones, viruses, vaccines, and antibodies for diagnostic and therapeutic uses. Hollow-membrane fibers are attractive media for the growth and support of microbial (bacteria, yeast, etc.) populations at very high cell densities (ten to the twelfth power per sq cm), and may provide the basis for a new family of high-capacity, continuous-production bioreactors. Immobilized enzyme reactors, which employ membranes as matrices for enzyme containment, are now gaining increasing popularity for the conduct of continuous biochemical transformations. Enzyme-containing membranes promise development of novel electrochemical and thermochemic sensors for detection and measurement of complex biochemical substances; they are expected to play an important role in the design of control instrumentation for biochemical manufacturing processes.
W84-00707

BIOCATALYSIS BY MEMBRANE-ATTACHED ENZYMES AND WHOLE MICROBIAL CELLS,
(Heinz (H.J.) Co., Pittsburgh, PA.
K. Venkatsubramanian.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 353-363, 8 Tab, 5 Ref.

Descriptors: *Membranes, *Enzymes, Biocatalysis, Microbial cells, Collagen, *Microbiological studies.

Bioconversion processes employing fixed enzymes and whole microbial cells is becoming a well-established art. A wide variety of inorganic and organic carrier matrices, as well as immobilization procedures, were employed for immobilizing enzymes or microbial cells. While the preferred physical form of these biocatalysts often tends to be pellets or beads used in a packed bed reactor, the membranous form offers several unique advantages over such reactor designs. Research effort was expended over the past decade in the development of biocatalytic reactor systems based on enzymes and cells immobilized on reconstituted collagen membranes. The key features of biocatalysis are highlighted.
W84-00708

MEMBRANE TECHNOLOGY APPLIED TO BIOCONVERSION OF MACROMOLECULAR SUBSTRATES AND UPGRADING OF PRODUCTS. A MODEL STUDY ON ETHANOL PRODUCTION FROM CELLULOSE,
Lund Univ. (Sweden). Dept. of Technical Microbiology.
B. Hagerdal, M. Lopez-Leiva, and B. Mattiasson.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 365-373, 1 Tab, 5 Fig, 26 Ref.

Descriptors: *Membranes, Economics, *Reverse osmosis, Bioconversion, Enzymes, Cellulose, Ethanol, *Alcohols, Separation techniques.

The use is discussed of membrane reactors for enzymatic degradation of macromolecular substrates in order to reduce product inhibition. In this study the degradative step is integrated with a process line containing reverse osmosis as well as bioconversion utilizing co-immobilized enzymes and microorganisms. This concept of a combination of membrane technology and biotechnology takes into account not only the fact that bioconversions generally are controlled by product inhibition but also that dilute product solutions will be obtained when these bioconversions are continuously operated. Bioconversions have to be optimized with respect to productivity as well as product concentration. When taking membrane technology into account these optimizations may concentrate more on productivity since the resulting dilute product stream can be upgraded in a suitable membrane unit operation.
W84-00709

MEMBRANE TECHNOLOGY AND COSTS; STATE OF THE ART,
Lund Univ. (Sweden). Dept. of Business Administration.
B. Bjerke.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 375-382.

Descriptors: *Membranes, *Economics, Reviews, Costs, Membrane processes, Separation techniques.

It is impossible to make calculations which are generally valid. There are too many assumptions which must be established before an individual case can be calculated, e.g., concerning volume treated, operating period, and membrane life. One can think of an 'average' situation looked at from such a systems level that components can be distinguished, i.e., (1) pretreatment, (2) reverse osmosis membranes (3) post-treatment (4) support systems, and (5) acceptance test. From this point of view one can easily find crucial factors such as membrane, operating/cleaning labor, and depreciation costs. Some industries are more suitable than others from an economic point of view, e.g. woodpulp, dairy, and foodstuff. Generally there are questions which are seldom asked. Such are the role of opportunity costs, start-up problems, and costs from help of experts. There are several advantages from using membrane technology for concentration, e.g. less need of energy, smaller installations, and environmental advantages. These factors will be stressed even more in the future. Membrane technology has therefore come to stay.
W84-00710

MEMBRANE LIFE, CAPACITY AND COSTS,
Paterson Candy International Ltd., Laverstoke (England).
D. Pepper.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 383-396, 5 Tab, 5 Fig, 7 Ref.

Descriptors: *Membranes, Membrane processes, Seawater, Brackish water, *Costs, Dairy industry, Food processing industry, Chemical industry.

Membrane life is determined as much by the way that the system containing the membrane is designed and used as by the chemical and physical stability of the membrane. Membrane life is not a fundamental property of the membrane. All membranes suffer from a gradual loss of throughput because of creep under the applied stress but this is predictable and can be allowed for in design. Chemical attack can be quantified and operating limits set to minimise it. Membranes already exist with adequate lifetimes for the treatment of brackish and seawaters and for applications in the dairy, food, and pharmaceutical industries. Many other applications will become possible, for example in the chemical industries, when more resistant membranes are available.
W84-00711

SYSTEM OPTIONS AND COSTS IN DAIRY ULTRAFILTRATION,
Alfa-Laval A.B., Lund (Sweden).
P. Dejmek, and H. Engwall.
Desalination, Vol 35, Nos 1/2/3, December 1980, p 397-400, 6 Fig, 2 Ref. (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980).

Descriptors: *Ultrafiltration, *Costs, Dairy industry.

The costs of ultrafiltration continue to be the focus of attention of presumptive users. While the cost structure of the total costs is well documented, the internal structure of the capital costs of ultrafiltration is less widely known. A breakdown of the first costs of typical dairy systems as delivered by Alfa-Laval is presented.
W84-00712

MEMBRANE PROCESSES FOR WATER SUPPLY AND REUSE - A QUESTION OF ENERGY CONSUMPTION AND COST,
Vattenbyggnadsbyran Ltd., Stockholm (Sweden). Div. for Water, Soil and the Environment.
B. Ericsson.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 401-421, 11 Tab, 9 Fig, 15 Ref.

Descriptors: *Desalination, Desalination plants, Brackish water, Seawater, *Water supply, Water reuse, Membrane processes, Reverse osmosis, Energy, Costs, MSF-RO dual-purpose,

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

Wastewater treatment, Multistage flash, Salbukh, Riyadh, Saudi Arabia.

Desalination of brackish water and seawater with reverse osmosis (RO), with special emphasis on costs and energy consumption, is discussed. Some aspects of and development trends in industrial and domestic applications of membrane processes are also taken up, particularly with regard to by-product recovery and water reuse in connection with advanced wastewater treatment. The first RO plant to be brought into operation in Riyadh, Saudi Arabia, is located at Salbukh. The investment and total operation costs for this plant have been calculated. The water cost is at least twice as high as in a continental U.S. location, due the very high cost of civil and local works in Saudi Arabia. A similar calculation has been made for RO seawater desalination. Increased energy costs during the last decade have directed R and D work for all desalination methods towards reducing energy consumption. Energy recovery in connection with RO seawater desalination is particularly feasible. Different methods for energy recovery are reported, the preferred methods depending on the size of the RO plant. A large underground RO plant for energy recovery, based on utilization of the static pressure instead of high pressure pumps, was studied. Another possible energy-saving, but also water quality improving method is proposed, viz. a combined multistage flash (MSF)-RO dual purpose plant. Excess power for RO seems to be more and more available in Saudi Arabia due to the high power/water ratio in MSF dual purpose plants compared to the real demand for power and water.
W84-00713

PRECONCENTRATION BY REVERSE OSMOSIS BEFORE EVAPORATION - POSSIBILITIES IN SWEDEN,
Lund Inst. of Tech. (Sweden). Div. of Chemical Engineering.
P. Eriksson.
Desalination, Vol 35, Nos 1/2/3, December 1980, p 423-429, 1 Tab, 2 Fig. (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980).

Descriptors: *Membranes, *Reverse osmosis, *Energy, Pulp and paper industry, Dairy industry.

An inventory was made on how much water is removed by evaporation in Sweden, and where it is technically and economically possible to save energy by preconcentration by reverse osmosis. It is possible, mainly in the pulp and paper and dairy industries. Annual savings of energy equivalent to 38,000 and 11,000 metric tons of oil, respectively, can be achieved in these industries.
W84-00714

CLOSING REMARKS,
Svenska Traeforskningsinstitutet, Stockholm.
L. Stockman.
Desalination, Vol 35, Nos 1/2/3, December 1980 (Comprising the Proceedings of the Symposium on Membrane Technology in the 80's, Ystad, Sweden, Sept. 29 - Oct. 1, 1980), p 431.

Descriptors: *Membrane processes, Membranes, Reviews, *Sweden.

Membrane techniques are in a state of rapid, dynamic development in which very capable people, institutes and companies are involved. Companies, especially Swedish, are encouraged to join the Swedish Membrane Technology foundation.
W84-00715

PROCEEDINGS OF THE INTERNATIONAL CONGRESS ON DESALINATION AND WATER REUSE, MANAMA, BAHRAIN, NOV. 29-DEC. 3, 1981,
Fairleigh Dickinson Univ., Teaneck, NJ.
M. Balaban, and R. Bakish.
Desalination, Vol 39, Nos 1/2/3, November 1981, p 1-532. International Desalting and Environment Association.

Descriptors: Desalination, Desalination plants, Distillation, Reverse osmosis, Electrodialysis, Solar distillation, Pretreatment, Scaling, Materials engineering, Energy, Economics, Management planning, Education, Middle East, American Continent, Europe, Mediterranean, Asia, Far East.

Second and final volume of these Proceedings of the international congress on desalination with the participation of scientists and engineers in the field. This volume contains 54 papers on Instrumentation, New energy sources, The Middle East, The American continent, Europe and the Mediterranean, Asia and the Far East, Energy and Economics, Education and Management, Related Topics. (Volume 38 of Desalination constitutes the first volume of the Proceedings).
W84-00716

DISTRIBUTED CONTROL SYSTEMS FOR DESALINATION,
Catalytic, Inc., Philadelphia, PA.
E. V. Kelley.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 3-21, 7 Fig, 6 Ref. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, *Computers, *Control systems.

Historically, desalination applications have not utilized direct computer control due to the relative simplicity of the typical desalination control systems, the cost of direct computer control, and the heretofore sophisticated operation and maintenance procedures required to implement a direct computer controlled system. As the size of desalination plants has increased for facilities in the Middle Eastern countries, the need for energy management and data acquisition has appeared in the form of ancillary computer systems in addition to the standard analog control system for the facility. An overview is presented of typical distributed control systems which have become more readily available in recent years. Emphasis is placed on the steps which have been taken by various manufacturers to simplify the implementation, operation, and maintenance of currently available systems and the importance of monitoring significant process variables which affect operating efficiency and the physical condition of the plant.
W84-00717

TODAY'S STATUS OF PH MEASUREMENT AND CONTROL IN DESALINATION PLANTS,
Foxboro Co., MA.
F. E. Moore.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 23-31, 4 Fig, 2 Ref. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Instruments, *Multistage flash, *Reverse osmosis, *Hydrogen ion concentration, Acid-dosing, Electrolyte dosing.

Horror stories about desalination plants are rampant: acid-dosed multistage flash plants needing retubing after two years; electrolyte-dosed plants working a little longer, reverse osmosis plants needing new membranes in a few years. Some of these troubles are blamed on poor hydrogen ion concentration measuring equipment. In an effort to determine today's real situation regarding hydrogen ion concentration measurement, a survey was conducted of the entire membership of the International Desalination and Environmental Association. The results prompted further in-depth discussions with knowledgeable people in the desalination field. This paper is based on the survey, the in-depth discussions, and 20 years of experience in the hydrogen ion concentration measurement field.
W84-00718

INSTRUMENTATION PROBLEMS IN LIBYN DESALINATION PLANTS,
Alfateh Univ., Tripoli (Libya).
H. El Hares.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 33 (Abstract only). (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Instrumentation, *Libya.

Some interesting instrumentation problems and their solutions occurring in the main Libyan desalination plants of West Tripoli, Zuwara, Sirte, Zliten and Beghazi-North are presented. Also comparisons are made and actual working life given for key instruments of different manufacturers.
W84-00719

CONTROL AND INSTRUMENTATION EXPERIENCE AT LOK ON PAI MSF SEAWATER DESALINATION PLANT,
Binnie and Partners, London (England).
A. R. George, and B. Tyler.
Desalination, Vol 39, Nos 1/2/3, p 35, December 1981 (Abstract only) (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Distillation, Seawater, *Multistage flash, Lok on Pai.

Critical measurements are discussed in multistage flash seawater distillation plants. These are hydrogen ion concentration and dissolved oxygen in feed and their associated control systems and the continuing acquisition and evaluation of corrosion data. The use of central processor to aid evaluation of date is described. Practices recommended for enhancing performance and security are given.
W84-00720

AN INTRODUCTION TO NEW ENERGY SOURCES FOR DESALINATION,
CH2M Hill Southeast, Inc., Gainesville, FL.
O. K. Buros.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 37-41, 23 Ref, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, *Energy sources, Solar stills.

The papers presented in the section 'New Energy Sources for Desalination' illustrate that a variety of new energy sources are being utilized to provide power for desalination. However, aside from solar stills there is only limited experience with pilot scale facilities using these new sources. The future of desalination with new energy sources depends on reducing the costs of producing reliable energy conversion devices and increasing the efficiency of the desalination units.
W84-00721

AN ASSESSMENT OF THE MARKET POTENTIAL FOR SMALL SOLAR POWERED DESALINATION PLANTS,
Kara Establishment, Jeddah (Saudi Arabia).
J. J. Turnage, and A. A. Husseiny.
Desalination, Vol 39, Nos 1/2/3, p 43-52, December 1981, 4 Tab, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Solar energy, Middle East, Small solar powered desalination(SSPD).

The introduction of a new technological system to the commercial market is helped by following established procedures for estimating the potential market for the product. The results are described of a preliminary market analysis for the manufacture and sale of small solar-powered desalination (SSPD) systems in Middle Eastern Countries. Overall results indicate that manufacture and sales of the SSPD system are promising from both technical and economical standpoints. Until prototypes are built, some caution is indicated for financing of production and for purchasing of equipment. Prototype systems are being developed to demonstrate in actuality the commercial acceptance and economic viability of the system.
W84-00722

DESIGN OF A COMMERCIAL SOLAR-POWERED GREENHOUSE,
Kara Establishment, Jeddah (Saudi Arabia).
T. O. Al Kasabi, S. I. Abdel-Khalik, T. E. Dix, R. Hagenson, and A. A. Husseiny.
Desalination, Vol 39, Nos 1/2/3, p 53-62, 5 Fig, 2 Tab, 1 Ref. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: Desalination, Desalination plants, Solar energy, Greenhouses, Irrigation.

A completely solar-powered greenhouse complex was designed for climate controlled food production in hot, humid environments. The concept uses passive design features to provide irrigation water from saline water sources. The overall system concept is discussed along with the solar still subsystem which has been designed to provide a continuous fresh water supply. While incorporating many innovative features, the use of proven technologies and passive design results in a system that should compete economically with current, more traditional designs.
W84-00723

TEST RESULTS FROM A SOLAR BOILER FOR SALINE WATER DISTILLATION,
California Univ., Berkeley. Sea Water Conversion Lab.
Z. M. Jundi, and B. W. Tleimat.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 63-70, 5 Fig, 10 Ref, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Solar distillation, *Multieffect flash, Distillation, Solar stills, Flat plate solar collector.

The performance of a low temperature, 50-70C, solar boiler is presented. The boiler consisted of a double-glazed flat-plate solar collector, a flash chamber, a water cooled surface condenser, a circulating pump, and a temperature-controlled preheater to simulate constant temperature thermal storae. Data were obtained on this boiler from October 1980 to May 1981. During this period, the instantaneous total incident solar radiation at noon, as measured by a pyranometer in the plane of the collector ranged from 0.7 to 1.0 kW per sq m and the diurnal total incident solar radiation ranged from 13 to 29 MJ per sq m per day. At these conditions the instantaneous efficiency of the collector ranged from 30 to 55 percent while the diurnal efficiency ranged from 20 to 44%. The performance of the solar collector was the dominant factor in determining the performance of this boiler. Low temperature steam, 50 to 70C, from such boilers can be produced to drive multieffect distillation systems using high performance evaporators for desalting sea water.
W84-00724

DESIGN OF A SMALL SOLAR-POWERED DESALINATION SYSTEM,
Florida Inst. of Tech., Melbourne.
T. E. Bowman, A. M. El-Nashar, B. H. Thrasher, A. A. Husseiny, and A. J. Unione.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 71-81, 4 Fig. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: Desalination, Desalination plants, Solar/thermal system, Reverse osmosis.

A design is presented for a solar/thermal system configured to power a reverse osmosis (RO) desalination unit to produce 7000 gallons of fresh water in an 8-hr period. A field of line-focus tracking solar collectors is used to heat a high pressure liquid-vapor water storage tank supplying two compound reciprocating steam engines, one direct-connected to the RO high-pressure pump and the other to an electric generator for auxiliary power. An auxiliary heating loop with an oil-fired boiler is also used to supply the steam engines. The system operates in either all-solar, all-oil, or mixed solar/oil modes. Primary operating mode is assumed to be a mixed solar/oil mode in which the oil-fired boiler is used only to prevent shutdown of the RO system during the course of a partly sunny day. In this mode, the RO system does not come on line in the morning until the solar collector field has brought the high-pressure storage tank to a point near maximum operating pressure. Thereafter, the oil-fired boiler comes on automatically whenever the storage tank is drawn down to a pressure near minimum full-power operation (due to inadequate or intermittent insolation) and remains on, supplying the steam engines, until the solar collectors have again brought the storage tank to the high-pressure cutoff. In the all-solar mode, the system continues to operate at reduced power as storage tank pressure drops below the point at which the oil-fired boiler would otherwise come on. A portion of the RO system is shut down to maintain pressure in the remainder. The all-oil mode is used whenever fresh water is required during non-sunny periods, or to increase fresh water production in sunny periods.
W84-00725

SOLAR DISTILLATION: THE SOLAR-DRIVEN CASE,
Sydney Univ. (Australia).
J. P. Gerofi, G. G. Fenton, and E. Mannik.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 83-94, 8 Fig, 1 Tab, 14 Ref, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Solar distillation, Economics, Solar stills.

Distillation systems are discussed where all the plant's thermal energy requirements are provided by solar energy. Fairly small capacity plants are considered operating in remote arid regions. Such systems consist of solar collectors and thermal storage coupled to a distillation plant. Each of these aspects is considered as well as the type of control strategy to be used. Using a dynamic computer simulation model, two solar-driven systems are considered: one using flat-plate collectors and a 76C multiple-effect evaporator (MEE) desalination plant, the other using evacuated tubular collectors and a 95C MEE plant. Various combinations of collector area and thermal storage volume are considered, and optimal values determined for each case. For the particular example chosen (100 cu m/day, located at 23 1/2 deg S) the flat-plate collector system was superior at current prices, giving an overall water cost of $5.82/cu m versus $7.34 for the second system. Both these costs are considerably less than water costs from conventional solar stills.
W84-00726

COMPARISON OF SOLAR RO AND SOLAR THERMAL DESALINATION SYSTEMS,
Sydney Univ. (Australia).
J. P. Gerofi, and G. G. Fenton.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 95-107, 1 Fig, 8 Tab, 11 Ref, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Solar reverse osmosis, Solar distillation, Economics, *Solar energy, Reverse osmosis.

The unit water costs from 100 cu m/day solar reverse osmosis (RO) and solar distillation plants are compared. RO plants powered by photovoltaic cells are already available, and distillation plants operated from solar collectors are being constructed. For the size chosen and these options it is concluded that distillation is cheaper than RO for salinities above about 6,000ppm. Solar ponds can provide both thermal and electrical energy more cheaply than the above options, but they do not yet have the market penetration of the more accepted systems. If solar ponds are used then distillation is cheaper than RO only for salinities above about 10,000ppm.
W84-00727

DESIGN AND OPERATION EXPERIENCE WITH SOLAR POWERED MULTISTAGE DESALINATION PLANTS,
Ecole Polytechnique Federale de Lausanne (Switzerland).
R. Kriesi.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 109-116, 2 Fig, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Solar energy, *Solar distillation, *Multistage flash, Distillation, Kuwait.

Desalination is a favourable application for solar energy and has a good potential for economic viability, since water demand is a consequence of abundant irradiation (no long term storage needed) and only low temperatures are necessary for the required thermal energy (simplicity of solar collector system). An R and D partnership for the development and implementation of solar desalination technology has been set up between the Swiss Federal Institute of Technology (fundamental development and laboratory testing), Atlantis Energy Ltd. (hardware design, construction and delivery) and the Kuwait Institute for Scientific Research (field testing). A 3-phase program is under way: Phase 1 (completed): Initial construction of a conventional MSF plant, laboratory and field tests. Design criteria for solar equipment resulted such as capability of operation under heavily fluctuating energy input conditions, minimization of mechanical energy consumption, simplicity of equipment, etc. Phase 2 (completed): Design of a new 'real solar' MSF-unit, meeting the above requirements, laboratory testing, field testing in Kuwait. Phase 3 (under way): Upscaling of the pilot plant to commercial sizes of 100 to 1000 cu m/day, optimization of the process, realization of a demonstration plant, coupled to a salt solar pond, specially developed for this purpose. Solar desalination has been demonstrated to be a reliable method of obtaining drinking water when using a specially developed salt solar pond system as heat source, water at lower prices is obtained compared with that from an oil-fired evaporator.
W84-00728

SOLAR DESALINATION: PROTOTYPE 'PITHON' A SPECIAL SOLAR MULTIPLE-EFFECT DISTILLER,
CEA Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France).
J. C. Deronzier, F. Lauro, and R. Ployart.
Desalination, Vol 39, Nos 1/2/3, Dec. 1981, p 117-123, 4 Fig, (2nd Vol. Proc. of International Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Solar multi-effect distillation, Solar distillation, Arabian Gulf, 'Pithon' prototype, Hagevap treatment.

Solar distillation is one of the future solutions to producing fresh water from the sea or from brackish water. The international market capacities range from 100 to 200 or 300 cu m/d. The French Atomic Energy Commission has designed a new type of evaporator which permits a good adaptation to solar collectors under the conditions of Arabian countries. A horizontal submerged tube multiple-effect process is used, operating at low temperature under atmospheric pressure ($T < 70C$) with Hagevap treatment. This process is well known in countries of the Arabian Gulf particularly in Kuwait. Operating at low temperatures avoids scaling and corrosion problems. Multiple-effect gives a very high performance ratio and low electrical consumption for pumping.
W84-00729

WIND AND SOLAR POWERED REVERSE OSMOSIS DESALINATION UNITS-DESIGN, START UP, OPERATING EXPERIENCE-,
GKSS - Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)
G. Petersen, S. Fries, J. Mohn, and A. Muller.
Desalination, Vol 39, Nos 1/2/3, p 125-135, December 1981, 8 Fig, 1 Tab, 5 Ref, (2nd Vol. Proc.

of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: Desalination, Desalination plants, Reverse osmosis, Solar energy, Wind, Plate modules, Photovoltaic solar generator, Wind converter, Mexico, Suderoog Island, Germany.

To demonstrate the operation of reverse osmosis (RO) units with GKSS plate modules coupled with unconventional energy supply systems, two projects are presently carried out by the GKSS research center applying a photovoltaic solar generator and a wind energy converter for a site in the Northern part of Mexico and a small island at the German coast of the North Sea, respectively. The solar generator with a designed peak power of 2.5 kW is developed by AEG and powers a RO unit for the desalination of brackish well water. The plant has been installed in Concepcion del Oro, Zacatecas, in spring 1980 and has been operated by the Mexican company DIGAASES in cooperation with AEG and GKSS since May 1980. The second project is a 6- kW wind-energy converter supplying 3 RO modules with a total membrane area of 30 sq m. After comprehensive component tests at the GKSS research center at Geesthacht the plant was installed at the very small island of Suderoog at the German coast of the North Sea. Test operation was started in December 1980.
W84-00730

WASTE HEAT POWERED REVERSE OSMOSIS PLANTS,
Envirogenics Systems Co., El Monte, CA.
R. A. Tidball, and R. Kadaj.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 137-145, 3 Fig, 4 Tab, 2 Ref, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Reverse osmosis, Biphase, Turbine, *Waste heat.

The purchased power required for operation of reverse osmosis (RO) systems can be greatly reduced or sometimes eliminated by reclaiming waste heat from diesel engines, gas turbines, flare gases, etc. This can be accomplished by using a biphase turbine to convert low level waste heat to shaft horsepower. The system can be designed to use waste heat from existing installations or to reduce the size of the generating equipment in new supplies. The biphase conservation turbine is driven by a two phase stream generated by flashing a superheated liquid through a nozzle to the turbine. The turbine can be directly coupled to a pump shaft, to an electrical generator or to a combination of the two. Performance of the turbine is discussed. The waste heat recovery turbine and a hydraulic turbine to recover energy from the high pressure concentrated brine can be combined into one system. The design is described of a seawater RO system using waste heat from an existing diesel generating unit. The system is designed to produce 750 cmd of 400-ppm water at an energy consumption of approximately 2.5 KWH of purchased power p/cu m. A discussion of available desalination capacity at various quantities and temperature levels of the waste heat is presented. A comparison of water costs obtained using this system and a conventional electrical drive is presented.
W84-00731

USABILITY OF LOW TEMPERATURE WASTE HEAT FOR SEA WATER DESALINATION,
Nord-Aqua Oy, Espoo (Finland).
R. Saari.
In: Desalination, Vol 39, Nos 1/2/3, December 1981, p 147-158, 9 Fig, 3 Ref. (2nd Vol Proc of Int Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Multieffect distillation, Seawater, *Waste heat.

Waste heat energy that is cooled away from a process appears at two very different temperature levels. The waste heat that is 50C warmer than the ambience, can be utilized by a multieffect-distillation process, and it is competitive to utilize it at least as thoroughly as the first-rate energy. At low temperatures, less than 20C above the ambient temperature, waste heat can be technically, and economically utilized, if the temperature difference is 7 to 15C, depending on the pumping energy cost.
W84-00732

OCEAN THERMAL ENERGY AND DESALINATION,
Alsthom-Atlantique, Grenoble (France). Neyrtec Div.
M. Rey, and F. Lauro.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 159-168, 5 Fig, 3 Tab, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Ocean circulation, *Thermal power, *Energy conversion, *Temperature gradient.

In 1981, the French physicist d'Arsonval was the first to suggest the harnessing of the temperature difference between the warm surface layers and cold deep layers of tropical oceans. Since then, several attempts have been made to convert this undepletable supply of thermal potential energy into mechanical energy and, later, into electricity. In recent years, various countries including France have launched thermal energy conversion (OTEC) programs. Tropical regions with useful temperature differences often lack both conventional energy resources and potable water. In such regions, OTEC plants could be used with advantage for the simultaneous production of power and desalinated seawater. An original seawater distillation scheme using surface water and the cold reject stream from an OTEC cycle is discussed. Power not required for distillation may be exported outside the plant. The combined distillation and OTEC scheme is compared with conventional desalination plant producing both potable water and electricity. The OTEC scheme appears highly flexible and shows considerable economic promise.
W84-00733

DEVELOPMENT OF SOLAR DESAL, A CODE FOR MODELING, SIMULATION AND DESIGN OF SOLAR DESALINATION SYSTEMS,
Science Applications, Inc., Ames, IA.
T. E. Dix.
Desalination, Vol 39, Nos 1/2/3, December, 1981, p 169-170 (Abstract only) (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination apparatus, *Solar distillation, Wind, Solar stills.

A computer code has been developed as a tool to aid design work of wind-powered and solar-powered desalting plants. The code accommodates for various solar energy sources deliver systems and RO and ED processes. Flow charts are presented with detailed description of the code, capability and limitations. The SOLAR DESAL program could also be used to simulate desalination units of reverse osmosis and electrodialysis which employ diesel generators.
W84-00734

ENGINEERING DESIGN OF A 6000 CU M/DAY SEAWATER HYBRID RO-ED HELIO-DESALTING,
Science Applications, Inc., Ames, IA.
A. A. Husseiny, and H. L. Hamester.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 171-172 (Abstract only) (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Desalination apparatus, Reverse osmosis, Solar plant, Electrodialysis, *Solar energy.

Employment of solar energy as a power source for desalination processes has been thought of as an evaluation of the solar stills which have been in operation for a long period of time. With the recent efforts to commercialize active collectors of solar radiation, interest in developing solar-powered desalting systems has been revived. Among the new viable concepts is the design of a hybrid reverse osmosis-electrodialysis commercial plant to desalt seawater. The design is based on the development of a stand-alone system that provides 6,000 cu m/day at a minimum cost of product which can eventually compete with cost of water from conventional desalting plants. A detailed design description, design parameters and cost estimates are provided.
W84-00735

DEVELOPMENT OF A MARINE OSMOTIC SOLAR STILL FOR A SEA WATER DESALINATION,
Ames-Ridgefield, Inc., IA.
R. Knighton.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 173 (Abstract only) (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Desalination apparatus, Solar energy, Membranes, *Solar stills, Seawater, *Marine osmotic solar still.

The development of a marine osmotic solar still for seawater desalination is described. Results of material tests and simulation system analysis are reported. A comparison is made with conventional solar stills and solar powered membrane desalination processes. Results of extensive marketing research are reported for various applications of the process.
W84-00736

SOLAR POWER/DESALINATION, PV ED SYSTEM,
Miami Univ., Coral Gables, FL. Lab. for Water Research.
G. Kvajic.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 175 (Abstract only) (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Electrodialysis, Seawater, *Photovoltaic system.

Photovoltaic/Electrodialysis, PV/ED, power/desalination system is studied in which the seawater feed is heated in the PV-cells. By varying feed concentration and temperature of the PV/ED system, one can control the ratio of power to water production within a large range so that various demands for power and water can be met.
W84-00737

RELIABILITY OF THE JEDDAH SEAWATER RO DESALINATION PLANT BASED UPON OPERATIONS EXPERIENCE,
Iowa State Univ., Ames.
I. I. Kutbi, A. M. Metwally, Z. A. Zabri, and A. A. Husseiny.
Desalination, Vol 39, Nos 1/2/3, p 179-191, 3 Fig, 7 Tab, 10 Ref, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Seawater, *Reverse osmosis, Jeddah, *Reliability, Saudi Arabia.

Demand on commercial reverse osmosis (RO) seawater desalination plants can be assured with increase in reliability and with high levels of performance. Such improvements can best be achieved through 'lessons learned' from experience gained in available RO systems such as the large Jeddah RO plant. Critical components which affect plant performance were identified and methods of improving the design are recommended. Failure data was extracted from operation and maintenance reports. An assessment is made of the impact of failures and outages on the availability of the RO desalination plant. The single largest influ-

ence on the effective capacity of a water supply system based on RO desalination of seawater is plant availability and maintainability. The design configuration of the plant has an impact on the acceptability of water supply system performance.
W84-00738

PERFORMANCE EVALUATION OF MSF PLANTS, THE CASE OF JEDDAH PLANTS,
Iowa State Univ., Ames.
I. I. Kutbi, Z. A. Sabri, and A. A. Husseiny.
Desalination, Vol 39, Nos 1/2/2, December 1981, p 193-204, 5 Fig, 9 Tab, 9 Ref, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1983).

Descriptors: Desalination, *Desalination plants, *Performance evaluation, Multistage flash distillation, Jeddah, Saudi.

The performance is reviewed of the Jeddah desalination plant during a period of 8 years of operation to provide insight into actual plant experience. Data were extracted from plant monthly reports and maintenance orders. The analysis provided here is based on objective evaluations of operations data and experience and is directed towards assessment of problems that can be mitigated in new designs of MSF plants and recommendations for improvement or modifications of existing designs or procedures.
W84-00739

PERFORMANCE STUDY OF WATER DESALINATION METHODS IN SAUDI ARABIA,
University of Petroleum and Minerals, Dhahran (Saudi Arabia).
A. G. Maadhah, and C. K. Wojcik.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 205-217, 2 Fig, 4 Tab, 3 Ref, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: Desalination, *Desalination plants, Seawater, Brackish water, Multistage flash distillation, Reverse osmosis, Electrodialysis, *Performance evaluation, *Saudi Arabia, Reviews.

Saudi Arabia is an arid desert country without rivers or sweet water lakes, however, it does have vast amount of groundwater and seawater. In order to make these waters suitable for human consumption and industrial use, most of their salts must be removed by some means. The desalination methods most frequently used in the Kingdom are: Multistage flash (MSF) evaporation, reverse osmosis (RO), and electrodialysis (ED). During the last decade, A spectacular growth of desalination plants has occured. This growth is expected to continue in the next decade. The present production capacity of all desalting plants in Saudi Arabia is estimated to be 750,000 cu m/day; this figure will be most likely tripled in the next five years. The performance was studied of the most significant desalination plants in the Kingdom. The plants, which include MSF and seawater and brackish water RO plants, were selected either because of their size or their importance to the desalination technology. The plants are briefly described and their performances are discussed.
W84-00740

OPERATIONAL EXPERIENCE OF 2 X 11,500 M SUPER 3 D MSF SEAWATER DESALINATION PLANT,
S. Khalaf, M. Alarrayedh, and A. M. Alawadi.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 219-227, 2 Fig, 3 Tab. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Distillation, Seawater, *Multistage flash distillation, Bahrain, Bare carbon steel, Corrosion, *Steel.

The operational experience with two 11,500 cu m/d multistage flash desalination plants which were located in Bahrain in 1976. On attempt to place in perspective the problems which this technology is presented. The particular difficulties which resulted from use of bare carbon steel are identified. The corrective measures which were taken to minimize the rate of corrosion are stated. Careful specifications of materials for such plants is essential, and the necessary expertise must be available at start up to achieve stable operation and to minimize down time.
W84-00741

EXPERIENCE IN COMMISSIONING LARGE DESALINATION PLANTS IN THE MIDDLE EAST,
Weir Westgarth Ltd., Glasgow (Scotland).
D. W. Black, and R. M. Morris.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 229-239, 1 Fig, 1 Tab. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Distillation, *Multistage flash distillation, Middle East.

Aspects of the design and construction of three major seawater multistage flash installations, with some 14 evaporators each producing about 5 mgd (22,000 cu m/d) are briefly reviewed. Initial problems were encountered with brine weir design at high brine rates, and painting. Remedial action was successfully incorporated in later plants in spite of the short timescale available. Recirculating brine pump sizing criteria, the performance of the on-load tube cleaning systems, and an external deaerator are discussed. After-condenser corrosion on air ejector systems is also reviewed. Some modifications to plant specifications are suggested in the light of experience gained with these units.
W84-00742

THE RIYADH WATER TRANSMISSION SYSTEM (RWTS),
Saline Water Conversion Corp., Riyadh (Saudi Arabia).
I. M. R. Jamjoom, P. Laesser, and A. H. Feizlmayr.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 241-254, 4 Fig. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov .29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Pipelines, *Water distribution, High pressure, Al-Jubail, *Saudi Arabia, *Riyadh.

The Riyadh Water Transmission System (RWTS), one of the biggest high pressure pipeline systems of the world, was designed to transport large quantities of potable water from the Al Jubail desalination plants on Saudi Arabia East Coast to Riyadh. The main features of the RWTS are: route length Al Jubail to Riyadh (466 km); maximum system design capacity (830,000 cu m/d); double line, pipe diameter (60 in (1524 mm), pipes made of steel similar to X 52 and X 60 outside coated with polyethylene and inside lined with cement mortar); steel weight of pipes (520,000 tons); total lifting head required (2340 m, closed high pressure system operating at station discharge pressures in the range of 50 bar); 6 pumping stations with a total installed capacity of 430 MW; and capacity of Riyadh High Point Terminal (300,000 cu m).
W84-00743

DEVELOPMENT OF ENVIRONMENTAL STANDARDS FOR COMBINED DESALINATION/POWER GENERATING STATIONS IN THE ARABIAN GULF REGION,
Lockheed Missiles and Space Co., Inc., Carlsbad, CA.
D. L. Brining, W. C. Lester, W. N. Jessee, D. A. O'Leary, and S. Bourgeois.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 255-260, 2 Tab, 2 Ref. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Dual purpose plants, *Environmental effects, *Powerplants, Arabian Gulf.

Environmental effects associated with desalination/power generation are classified into intake and discharge components. The intake component consists of entrainment and impingement problems while the discharge component comprises chemical and physical problems associated with the receiving waterbody. Each component is discussed relative to marine communities in the receiving waterbody and a methodology is presented for establishing an environmental management policy which will protect these communities.
W84-00744

EXPERIMENTS WITH DESALINATION OF ARABIAN GULF WATER,
M. El Salem.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 261-271, 6 Fig, 5 Tab, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination processes, Membranes, *Reverse osmosis, Plate-and-frame, Thin films, *Composite membranes.

With the 'plate-and-frame' reverse osmosis system and a new thin film composite membrane it has been possible to desalt very salty water (43.000 ppm). A minimum of pretreatment has been necessary because the membranes are very resistant to pH and temperature, and the flow rate in the plate-and-frame modules is very high. The raw water is pumped directly to the multi-media filter, followed by a 25-micron cartridge filter. The growth of algae and bacteria is prevented by irradiation with UV-light. After the pretreatment the water is pumped into the modules and desalted. The economy of the process is good because of the high capacity of the membranes and the small degree of pretreatment.
W84-00745

HEAT TRANSFER AND FLUID FLOW CHARACTERISTICS IN FLASH DESALINATION UNITS,
Cairo Univ., Giza (Egypt). Faculty of Engineering.
E. E. Khalil, M. M. Hilal, M. F. El-Fouly, and H. Z. El-Mogy.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 283-294, 15 Ref, 5 Fig, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Distillation, *Flash distillation.

The effects were investigated of different operating and geometrical parameters on the flashing efficiency of water in a single stage flashing chamber. This chamber used a submerged rectangular orifice as flow control area. Experiments were performed to investigate the effects of flow rate, liquid level in the flashing chamber, liquid inlet temperature, and flashing range on the flashing efficiency under various design conditions. These comprise flow with baffle placed in the fleshing chamber and wire meshes placed at the orifice to increase the turbulence level. The efficiency increased with the increase of the turbulence levels, flashing range, and liquid inlet temperature; the efficiency deceased with the increase of the flow rate and liquid level in the flashing chamber. The application of numerical procedure to predict flow pattern and heat transfer in the flashing chamber is introduced as a powerful design tool.
W84-00746

GROUND WATER RESOURCES IN FAYOUM AREA, EGYPT,
Zagazig Univ. (Egypt).
B. Mabrook, F. Sweilm, and R. El Sheikh Shoheib.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 295 (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Groundwater, *Recharge, Isotope studies, Fayoum area, Egypt, Chemical analysis, Quaroom lake, Nile Valley, Cairo.

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

The Fayoum area is located to the west of the Nile Valley, southwest of Cairo. It is a depression of an area of about 2000 sq km oriented in NW/SE direction. The Fayoum Province is connected to the Nile Valley by an old channel. To the northwest of the Fayoum area lies Quaroon lake with a salinity of about 4%, which is close to that of seawater. As a result of geological structure of this area, about 7 springs are scattered in the area. The area gets its main fresh water supplies from Bahr Yousel Canal, however, a considerable quantity of water is supplied from groundwater recharged from the cracked and cavernous limestone. Groundwater is recharged from the Nile and not from Bahr Yousef. Local groundwater is regarded as a source for some water inflow to Bahr Yousef. The recharge pattern of the groundwater is given. The contribution of the salty water of Quaroom lake is discussed.
W84-00747

ORIGIN OF SUBSURFACE WATER IN KHARTOUM PROVINCE, SUDAN,
Zagazig Univ. (Egypt).
B. Mabrook, F. Sweilm, and R. El Sheikh Shoheib.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 297 (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: Subsurface water, *Groundwater, Aquifers, *Hydrology, Khartoum, *Sudan, Nubia sandstone, El Gazira foundation, Egypt.

The study of the groundwater resources in Khartoum Province and the possibilities of their development have led to the question of hydrochemical variation with subsurface water origin. A combination between hydrogeological conditions with chemical and isotopic analyses is given for evaluation of the water resources. The principal water bearing formation are Nubia sandstone, El Gazira formation, and the alluvial wadi deposits. The storage capecity of the different aquifers as well as annual storage change are estimated. The hydrochemical composition of the aquifers reflects the continental NaHCO sub 3 and Na sub 2 SO sub 4 water types. Subsurface water is recharged from pluvial periods and present running water. Local groundwater is regarded as a source for some water inflow to running water.
W84-00748

CLOSED CYCLE TEXTILE DYEING:FULL SCALE RENOVATION OF HOT WASH WATER BY HYPERFILTRATION,
Carre, Inc., Seneca, SC.
C. A. Brandon, D. A. Jernigan, J. L. Gaddis, and H. G. Spencer.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 301-310, 3 Fig, 2 Tab, 5 Ref. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination processes, Membranes, *Hyperfiltration, Recycling, Textiles, *Dyes.

A full scale dynamic hyperfiltration system has been coupled to an operating dye range. The hyperfiltration system, its function in the recycle process, preliminary performance, and economic impact are described.
W84-00749

VIRGIN ISLANDS WATER AND POWER AUTHORITY (VIWAPA) HORIZONTAL TUBE, FALLING FILM, LOW TEMPERATURE 1.25 MGD MULTI-EFFECT DISTILLATION DUAL PURPOSE PLANT,
Virgin Islands Water and Power Authority, St. Thomas.
T. R. Blake, and G. Willocks.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 311-322, 3 Fig, 3 Tab, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Distillation, Horizontal tube falling film, Multieffect distillation, *Dual purpose plants, Virgin Islands.

Three 1.25-MGD horizontal-tube, falling-film, low-temperature, multieffect distillation units commissioned. These units are described with special emphasis made on the criteria for their selection and various aspects of dual purpose operation.
W84-00750

THE CARIBBEAN, THE OTHER AREA OF CONCENTRATION OF DESALINATION PLANTS,
Fairleigh Dickinson Univ., Teaneck, NJ.
R. Bakish.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 323-334, 2 Tab, 10 Ref, 6 Fig, (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Caribbean.

From 1928 when the first land-based desalination plant was installed on the island of Curacao in the Dutch Antilles today, there are five decades of uninterrupted success for the Caribbean in the role of 'principle actor' in the play 'Better Water Supply Through Experience and Adoption of Advanced Desalination Technology'. It is almost certain that under the continued pressure of energy costs and conservatism elsewhere in the world that this location will continue to maintain its leadership in innovation. The population and industrial growth of the region will continue to fuel the growth of desalination.
W84-00751

DESALINATION IN MEXICO,
Bosques de la Herradura, Mexico City.
R. Manjarrez.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 335 (Abstract only) (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, *Organizations, Political aspects, Mexico.

For the last 20 years Mexico has been gradually installing desalination plants for a diversity of purposes. Within the Mexican government desalination activities have been promoted by two agencies. The first has been responsible for desalination in service of better quality water for power generation while in the alternate the emphasis has been in brackish and saline water conversion for community potable and consumer related water supplies. The private sector has in most instances also relied on the government agencies for satisfying of industrial needs but not to the exclusion of private industry desalination plant construction. The effectiveness of the approach utilized by the government agencies active in the field is reviewed along with the possible and potential impact of the use of desalination by the private sector.
W84-00752

REDUCING AND MONITORING CORROSION IN MSF EVAPORATORS IN THE CHANGE-OVER FROM ACID TREATMENT TO TREATMENT WITH ADDITIVES,
Nalco Italiana S.p.A., Rome (Italy).
G. F. Casini, I. S. Di Simone, and M. Minervini.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 339-350, 3 Fig, 1 Tab, 11 Ref. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Corrosion, *Multistage flash distillation, Evaporators, Scaling, Acid treatment, *Additives, Polymers.

A multistage flash plant operating in the Mediterranean area is discussed where seawater acid treatment was replaced by scale control through the use of a proprietory polycarboxylic synthetic polymer. Corrosion effects were monitored in the brine and in the distillate system. The results obtained make manifest the less corrosive conditions on both Copper Alloys (90/10 Cu-Ni) and Carbon Steel during the additive treatment.
W84-00753

STUDIES, TESTING AND DEVELOPMENT OF A LINE OF BRINE RECIRCULATING PUMPS FOR SEA WATER DESALINATION INSTALLATIONS,
Bergeron S.A., Paris (France).
A. Le Grand, and J. F. Lapray.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 351-361, 5 Fig, 2 Ref. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Distillation, Brines, *Pumps, Materials testing, Corrosion, *Multistage flash distillation.

The different steps involved in design and testing of brine recirculation pumps are reviewed particularly regarding reliability against wear and corrosion. The running conditions of the pumps depend on the nature of the fluid pumped and its temperature. The large range in capacity and low suction head enable the pumps to endure difficult conditions. The development program for a complete pumping range for multistage flash (MSF) desalination plants includes: design and model testing of the hydraulic part, research platform tests for checking and increase of hydraulic performance, especially for cavitation, design of a pump prototype for 6000 cu m/d MSF unit (1.6 mgd), and endurance test for loop simulation in the last stage of MSF. In 1980 there were 4 runs of 1000 h each with dismantling and examination of all parts at the end of each run. Pumps were designed for MSF industrial plants of 10,000 and 20,000 cu m/d (3 and 6 mgd).
W84-00754

DESALINATION AND RENEWABLE ENERGIES - A FEW RECENT DEVELOPMENTS,
CEA Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France).
J. J. Libert, and A. Maurel.
Desalination, Vol 39, Nos 1/2/3, p 363-372, December 1981, 7 Fig, 2 Tab, 2 Ref. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Energy, *Solar energy, *Wind, Thermal power, Distillation, Reverse osmosis, Solar stills, Greenhouses.

The research work carried out by the 'Commissariat a l'Energie Atomique' with respect to desalting by renewable energies was oriented towards the use of solar energy, wind energy, and the thermal energy of oceans. The results obtained in the area of reverse osmosis are given and associated either with a solar motor or with an aerogenerator. A solar desalting greenhouse is described.
W84-00755

COMBINED MSF/VTE-MODULES FOR HYBRID THERMAL SEAWATER DESALINATION PLANTS,
Dortmund Univ. (Germany, F.R.).
J. Hapke, and B. Uckermann.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 373-384, 6 Fig, 12 Ref. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Seawater, *Multistage flash distillation, Evaporators, Computer models, Heat exchangers.

The design of combined multistage flash/vertical tube evaporators (MSF/VTE)-modules of seawater desalination plants is described. A computer aided model for the determination of the mass and energy balance as well as for the rating of heat exchanger surfaces was established. Moreover the dependence of the product portions in the MSF/VTE-parts and the specific energy requirement on the operation and plant variables was analysed. The heating-surface-rating based thereon

is utilized for design studies of standardized modules of a MSF/VTE-plant with a capacity of 5 MGD.
W84-00756

ACTIVITIES IN SPAIN,
Babcock and Wilcox Espanola S.A., Madrid (Spain).
F. Cantera, J. Guzman, and R. Sterner.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 385-396, 3 Fig, 6 Tab, 3 Ref, (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Water supply, *Water demand, Spain, Balearic Islands, Canary Islands.

The problem of water scarcity both in the peninsula (Meditteranean) and in the Balearic and Canary Archipelagos looking to the year 2000 is analyzed. Resources and future demand are quantified in detail and the deficit that will occur from 1981 to 2000 is established. It is proposed that desalination facilities be planned with a view to resolving this problem. Accomplishments to date are summarized for municipal and industrial plants as well as for experimental or pilot plants.
W84-00757

DESALINATION IN AUSTRALIA - PAST AND FUTURE,
Sydney Univ. (Australia).
G. G. Fenton, and J. P. Gerofi.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 399-411, 6 Fig, 3 Tab, 17 Ref. (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Reverse osmosis, Distillation, Vapor compression distillation, Electrodialysis, *Australia.

Despite its vast arid areas, Australia only has a very small proportion of the world's installed desalination capacity. Current plants are surveyed. Some of the operational problems that have occurred are outlined. Demineralisation plants are also considered. The water resources of Australia are reviewed, and areas delineated where desalination might be applicable. Within the context of the energy sources available in different localities, the potential applicability of various desalination technologies is discussed.
W84-00758

OPERATING EXPERIENCE ON RO SEA WATER DESALINATION PLANT AT CHIGASAKI LABORATORY,
Water Re-Use Promotion Center, Tokyo (Japan).
Y. Kunisada, K. Ohta, H. Kaneda, M. Hirai, and Y. Murayama.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 413-421, 5 Fig, 3 Ref, (2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Reverse osmosis, *Membranes, Chigasaki, Hollow fiber modules, Spiral wound modules, Japan.

A demonstration plant with a capacity of 800 cu m/d has been operating satisfactorily in Chigasaki Laboratory since September 11, 1979. The plant has two sets of modules, namely hollow fiber and spiral wound types. These two types of modules have been operated alternately every other month, being supplied sea water from the same pretreatment facility and the same high pressure pump. The accumulated operation time of each module has exceeded 5,000 hours. The operation result shows high recovery ratio, low energy consumption, and good quality of product water.
W84-00759

OPTIMIZATION OF INTEGRATED COGENERATION POWER PLANT AND DESALINATION PLANT SYSTEMS FOR A RANGE OF POWER AND WATER SUPPLY REQUIREMENTS,
Gibbs and Hill, Inc., New York.
L. F. Giannuzzi, O. E. Horn, and M. Nakhamkin.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 437-446, 7 Fig, (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, *Economic evaluation, Optimization.

Comparative economic analysis is presented which shows necessity of integrated power and desalination plants optimization rather than separate optimization of power generating and desalination units. This analyses introduces: (1) calculational procedure and resulting curves for cogeneration plant selection for a range of power and steam demands; (2) conceptual procedure for integrated power plant and desalination plant system optimization; and (3) Results of comparative economic analysis of integrated power desalination plant optimization as compared with separate power plant and desalination plant optimization.
W84-00761

THE APPLICATION OF PELTON TYPE IMPULSE TURBINES FOR ENERGY RECOVERY ON SEA WATER REVERSE OSMOSIS SYSTEMS,
Hayward-Tyler Pump Co., Burlington, VT.
D. J. Woodcock, and I. M. White.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 447-458, 7 Fig. (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination apparatus, Reverse osmosis, Seawater, Energy recovery, Costs, *Turbines.

Impulse turbine technology is well-established and readily adaptable to energy recovery systems for seawater reverse osmosis. The broad operating range and standardized package approach allows a high level of design engineering availability and flexibility for standard plant sizes from 30,000 GPD to 3 MGPD. The high-efficiency, simple design and operating requirements of impulse turbines, makes them particularly attractive for energy recovery systems. Reductions of approximately 45% in required energy can result in significant energy savings and improve the competitive price for fresh water produced from seawater reverse osmosis. As the world requirement for fresh water grows, combined with the demand for conservation of oil and the increase in energy cost, the attraction toward impulse turbine energy recovery systems will similarly grow over a wider range of economic conditions and plant sizes.
W84-00762

AN INTEGRATED SELF SUFFICIENT MULTIPURPOSE PLANT FOR SEAWATER DESALINATION,
Kraftwerk Union A.G., Erlangen (Germany, F.R.).
K. Kuenstle, and G. Brunner.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 459-474, 5 Fig, 1 Tab, 2 Ref. (Comrising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, Desalination plants, Seawater, *Multistage flash/vertical tube evaporator, Drinking water, Chemical potential.

A multipurpose plant is described, which produces drinking water and chemicals from seawater. The most important part of the plant consists in a combined multistage flash/vertical tube evaporator, which operates on a high economy ratio and enables also a high concentration of the brine. These two facts are due to a special treatment of the evaporator feedwater by chemical agents produced from the concentrated brine. A surplus of these chemicals can be sold. The energy supply of the complex is assured by an adequate power station, which provides process steam and electricity at such a ratio as to minimize fuel cost.
W84-00763

EDUCATION AND TRAINING IN DESALINATION AROUND THE WORLD,
Fairleigh Dickinson Univ., Teaneck, NJ.
R. Bakish.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 477-482, 4 Ref. (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, *Education, *Training, Desalination plants.

The need for education and training remains as great as ten years ago, and in principle all that is needed is a change of attitude. The problem then, as it is now, is the fact that those who need the trained personnel must realize that the need is real. Once this is accomplished, they must add the cost of training to the plant costs and be prepared to cover them. It appears that perhaps the most difficult task is that of educating plant management to the need for trained operators.
W84-00764

A NEW IDEA FOR TRAINING OPERATORS,
A. De Maio, F. Fioravanti, and G. Odone.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 483-487, 1 Fig, 4 Ref. (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: Desalination, *Desalination plants, *Training.

Experience in training personnel in desalination plant operation is described.
W84-00765

HANDLING OF FUZZY DECISIONS IN THE ENGINEERING MANAGEMENT OF LARGE DESALINATION PLANTS,
Riyadh Univ. (Saudi Arabia). Coll. of Engineering.
A-R. F. Abdul-Fattah.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 489-490 (Abstract only) (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: Desalination, *Desalination plants, *Management planning, Fuzzy set theory.

Engineering managers of large desalination projects often face several alternate strategies, the choice among which is rather unclear due to the lack of specific statistics to favor one choice over the others. Usually, the manager eliminates some options in a preliminary screening process, thus ending with a limited but viable alternative, each of which has its own merits. Fuzzy set theory provides a practicable tool in cases of management decisions under uncertainty where the factors affecting the decision are imprecise in nature. Fuzzy decision-making utilizes the set theory to provide ranges representing subjective judgements in absence of precise quantitative measures. The approach has been formalized in an interactive computer code which can be easily used by managers without the need for familiarization with the theoretical foundations of set theory.
W84-00766

A TAILORED PROCESS FOR REMINERALIZATION AND POTABILIZATION OF DESALINATED WATER,
Italconsult, Rome (Italy).
E. Gabbrielli.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 503-520, 1 Fig, 4 Tab, 20 Ref. (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Desalination, *Water treatment, *Potable water, Drinking water, Mineralization, Remineralization, Potabilization.

Economic analysis of feasible remineralization and potabilization policies for desalination water emphasizes the desirability of a process producing fresh water which is of high quality in every respect (health, stability, palatability, etc.). In fact

the cost of such a process is only a fraction of that required for actual desalination (7.5% in the reported case). A complete remineralization and potabilization process is discussed particularly suited for desalinated water with relatively low residual TDS. The process is based on the use of natural carbonate rocks and CO sub 2, and enables all the basic stability parameters of the fresh water produced to be adjusted to the desired values, even in the presence of relatively large quantities of chlorides (100-200 ppm) and fairly high final TDS (400-500 ppm); at the same time purchase of large quantities of manufactured salts is avoided. The critical steps in designing such a plant are outlined and a comparative assessment is made of the capital and running costs of the suggested process and of another using manufactured salts such as CaCl sub 2 and NaHCO sub 3. The remineralization and potabilization unit is increasingly becoming a specialized part of the desalting plant, the design of which calls for specific know-how.
W84-00768

3B. Water Yield Improvement

WATER INFORMATION FOR NORTHWESTERN MISSOURI--A PLANNING DOCUMENT,
Geological Survey, Rolla, MO. Water Resources Div.
J. Skelton, E. J. Harvey, and D. E. Miller.
USGS Water Resources Investigation, 1982. 58 p, 7 Fig, 12 Tab, 22 Ref.

Descriptors: Water resources planning, *Potential water supply, *Glacial drift, *Alluvium, *Low flow, *Missouri, Population growth rates, Water quality, Water use, Gaging stations, Missouri River, *Streamflow statistics, Coal gasification, Pennsylvanian bedrock.

Water supplies are limited in much of northwestern Missouri, and water-resources data are also limited. The report presents a summary of hydrologic data and an evaluation of areas where future hydrologic investigations would be most useful. The largest and most dependable surface-water supplies that can be obtained without storage from tributary streams are from the lower Grand, Nodaway, and Chariton Rivers. The sources of ground water in order of quantities available are the Missouri River alluvium, glacial drift, tributary stream alluvium, and Pennsylvanian bedrock. Irrigation and industry are concentrated along the Missouri River where alluvial ground water is abundant. (USGS)
W84-00810

3C. Use Of Water Of Impaired Quality

WATER QUALITY OF COAL DEPOSITS AND ABANDONED MINES, SAGINAW COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00926

3D. Conservation In Domestic and Municipal Use

EVALUATING THE EFFECTIVENESS OF PROMOTING RESIDENTIAL WATER CONSERVATION THROUGH EXHIBITS,
Virginia Water Resources Research Center, Blacksburg.
K. P. Sevebeck, and W. R. Walker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140565, Price codes: A10 in paper copy, A01 in microfiche. Completion Report, August 1983. 254 p, 30 Ref, 18 Append. OWRT C-10048-C and T(No 1448)(1), 14-34-0001-1448.

Descriptors: *Water conservation, *Conservation, *Domestic water conservation, *Education, Computer programs, *Exhibits, Computers, Domestic water, Water quality, Water quantity, Water use, Technology transfer.

This report describes how the Virginia Water Resources Research Center designed, constructed, implemented, and evaluated an exhibit program on residential water conservation. The report contains detailed information on the components of five exhibits and includes specific information on fabricating audio-visual displays, visitor participatory units, computer programs, and written educational materials to promote residential water conservation. Appendices list sources for equipment; describe computer programs; present construction drawings and exhibit photographs; and give sample evaluation and interview questionnaires, promotional materials, and three publications. Evaluation of the exhibit program showed that an exhibit is an effective medium for promoting residential water conservation and for changing citizen attitudes about water resources.
W84-00963

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1980-NOVEMBER 30, 1981,
Geological Survey, Milford, PA. Water Resources Div.
F. T. Schaefer, and R. E. Fish.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $14.25 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-341, 1982. 115 p, 9 Fig, 20 Tab.

Descriptors: *Delaware River, *Diversion release, Water management, *Drought, Water quality, Water supply, Salt water intrusion, Reservoir yield, *Regulation, Supply, Interbasin transfers.

Water supply conditions at the beginning of the year were marginal in marked contrast to those for the preceeding nine years. Discharge of the Delaware River at Montague, New Jersey, was only 72% of median as compared to 68% in excess of median the previous year. In December, with reservoir storage again declining, further reductions in both diversions and releases were imposed. With consent of all the parties, reductions were effected on December 20 limiting New York City diversions to 560 mgd, New Jersey to 65 mgd, and the required discharge at Montague was targeted at 1550 cfs. To conserve supplies, additional reductions were imposed in January when the Delaware River basin Commission formally declared a drought. New York City's limitations was set at 520 mgd and that for New Jersey at 62 mgd. Montague flows were targeted between 1100 cfs, depending upon the location of the salt front in the estuary. Water quality of the Delaware River and Estuary was monitored on a continuous basis at eight sites for most of the year and on a monthly basis at ten sites to accurately locate the salt front. Highest concentrations observed at the Benjamin Franklin Bridge site was 133 mg/l (milligram per liter) on February 2. (USGS)
W84-01040

3E. Conservation In Industry

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1980-NOVEMBER 30, 1981,
Geological Survey, Milford, PA. Water Resources Div.
For primary bibliographic entry see Field 3D.
W84-01040

4. WATER QUANTITY MANAGEMENT AND CONTROL

4B. Groundwater Management

GEOHYDROLOGIC RECONNAISSANCE OF DRAINAGE WELLS IN FLORIDA--AN INTERIM REPORT,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. O. Kimrey, and L. D. Fayard.
Available from the OFSS, USGS Lakewood, CO 80225, Price: $8.00 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-860, 1982. 59 p, 14 Fig, 6 Tab, 41 Ref.

Descriptors: *Drainage wells, *Injection wells, *Artificial recharge, *Groundwater pollution, Underground storage, Carbonate aquifers, *Florida, Statewide reconnaissance.

Drainage wells are used to inject surface waters directly into an aquifer, or shallow ground waters directly into a deeper aquifer, primarily by gravity. Such wells in Florida may be grouped into two broad types: (1) Surface-water injection wells, and (2) interaquifer connector wells. Surface-water injection wells are commonly used to supplement drainage for urban areas in karst terranes of central and north Florida. Data are available for 25 wells in the Ocala, Live Oak, and Orlando areas that allow comparison of the quality of water samples from these Floridan aquifer drainage wells with allowable contaminant levels. Comparison indicates that maximum contaminant levels for turbidity, color, and iron, manganese, and lead concentrations are equaled or exceeded in some drainage-well samples, and relatively high counts for coliform bacteria are present in most wells. Interaquifer connector wells are used in the phosphate mining areas of Polk and Hillsborough Counties, to drain mining operations and recharge the Floridan aquifer. Water-quality data available from 13 connector wells indicate that samples from most of these wells exceed standards values for iron concentration and turbidity. One well yielded a highly mineralized water, and samples from 6 of the other 12 wells exceed standards values for gross alpha concentrations. (USGS)
W84-00865

LAND SUBSIDENCE IN THE SAN JOAQUIN VALLEY, CALIFORNIA, AS OF 1980,
Geological Survey, Sacramento, CA. Water Resources Div.
R. L. Ireland, J. F. Poland, and F. S. Riley.
Available from the OFSS, USGS Lakewood, CO 80225, Price: $18.25 in paper copy, $4.50 in microfiche. USGS Open-File Report 82-370, June 1982. 129 p, 70 Fig, 6 Tab, 55 Ref.

Descriptors: *Subsidence, *Extensometers, *Groundwater, *Confined aquifer, *Unconfined aquifer, *California, San Joaquin Valley, Los Banos-Kettleman City Area, Tulare-Wasco Area, Arvin-Maricopa Area.

Land subsidence due to ground-water overdraft in the San Joaquin Valley began in the mid-1920's and continued at alarming rates until surface was imported through major canals and aqueducts in the 1950's and late 1960's. In areas where surface water replaced withdrawal of ground-water, water levels in the confined system rose sharply and subsidence slowed. In the late 1960's and early 1970's water levels in wells recovered to levels of the 1940's and 1950's throughout most of the western and southern parts of the Valley, in response to the importation of surface water through the California aqueduct. During the 1976-77 drought data collected at water-level and extensometer sites showed the effect of heavy demand on the groundwater resevoir. With the 'water of compaction' gone, artesian head declined 10 to 20 times as fast as during the first cycle of long-term drawdown that ended in the late 1960's. In the 1978-79 water levels recovered to or above the 1976 pre-drought levels. The report suggests continued monitoring of land subsidence in the San Joaquin Valley. (USGS)
W84-00932

GROUNDWATER MANAGEMENT IN THE SOUTHEAST,
North Carolina State Univ. at Raleigh.
D. H. Howells, and J. C. Warman.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR3, p

321-328, October, 1982. 5 Ref. OWRT B-123-NC and B-125-NC.

Descriptors: *Groundwater management, *State jurisdiction, Symposium, Groundwater pollution, Legal aspects, Legislation, Research priorities, Administration, Conjunctive use, Well regulations, Institutional constraints, Information exchange, Water supply, *Southeast U.S.

This paper summarizes and critiques groundwater management programs in the southeastern (U.S.) states as presented in papers at the Southeast Conference on Groundwater Management, Birmingham, Alabama, January 30-31, 1980. Legal and administrative issues, groundwater pollution, and geological diversity are discussed. Groundwater allocation is handled on a statewise basis in Georgia, a regional basis in Florida, and a capacity use basis (notably unsuccessful) in Mississippi, North Carolina, South Carolina, and Virginia, and is not legislated in Alabama and Tennessee. Organizational arrangements for administration of programs vary widely, from shared responsibility among agencies to an all-state authority and regional management districts. Groundwater characterization studies are more advanced in the coastal region than in the Piedmont and mountain areas. Alabama has a comprehensive program to minimize groundwater contamination from waste disposal operations. North Carolina and Florida are the only states in the Southeast with groundwater quality classfication systems. Conjunctive management of surface water and groundwater has received little attention to date in the Southeast. Natural groundwater problems include excessive fluoride concentration, hardness, radium and radon, corrosivity, excess iron and sulfates, and taste and odor problems. The most common man-made water quality problems are caused by poorly located septic tanks, wells transmitting surface flows to the aquifer, and industrial waste disposal. Recommendations for needed legislation, institutional agreements, funding, research, data transfer, and education are listed. (Cassar-FRC)
W84-00955

THE ECONOMIC VALUE OF GROUND WATER RECHARGE FOR IRRIGATION USE,
Nebraska Univ.-Lincoln. Dept. of Agricultural Economics.
R. J. Supalla, and D. A. Comer.
Water Resources Bulletin, Vol 18, No 4, p 679-686, August, 1982. 1 Tab, 19 Ref. OWRT A-065-NEB.

Descriptors: *Water supply, *Model studies, *Water resources development, Irrigation, Financial aspects, *Aquifer recharge, Aquifers, Groundwater, Pumping, Artificial recharge, Groundwater management, *Nebraska.

A methodology was sought for estimating ground water recharge benefits in irrigation use areas, and that methodology was used to estimate ground water recharge benefits for selected situations. These objectives were addressed using a Nebraska case. As presented, the methodology separates recharge benefits into two components: pumping costs savings and aquifer extension benefits. Simplified procedures designed for use by state and federal water planning agencies are presented for each recharge benefits component. Experience indicates that the required data, time, and computer resources for the model were within the range which would permit use of the model for first round, reconnaissance level studies as well as for more comprehensive analyses. Results of recharge benefit calculations indicate that benefits in irrigation use areas probably range from less than $2.00 to over $6.00 an acre foot. A comparison to published data on recharge costs concludes that single purpose recharge programs to augment water supplies for irrigation are certainly economically unfeasible. However, the analysis indicates that the benefits of recharge are probably substantial enough to merit their consideration as part of appropriate multipurpose water projects. (Baker-FRC)
W84-00957

AN ENGINEERING ECONOMIC ANALYSIS OF ARTIFICIAL RECHARGE IN A CONJUNCTIVE IRRIGATION PLAN IN THE COLUMBIA BASIN PROJECT, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
M. R. Karlinger, and A. J. Hansen, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196022, Price codes: A03 in paper copy, A01 in microfiche. USGS Open-File Report 81-67, 1983. 28 p, 6 Fig, 7 Tab, 6 Ref.

Descriptors: *Artificial recharge, *Irrigation practices, Irrigation wells, Surface irrigation, Economic feasibility, *Columbia Basin Project, *Washington, *Conjunctive use.

An appraisal-level engineering economic cost analysis was performed for two primary types of irrigation systems in a portion of the Columbia Basin Project- a surface-water irrigation system in which water is supplied via canals and laterals, and a system in which surface water is brought to recharging wells and eventually to farms using the transmissive properties of the aquifer and pumping. At 1979 electric power rates, the artificial-recharge irrigation scheme is a viable alternative to surface-distributed irrigation systems, but as electric rates increase, its viability decreases. At three times the 1979 rate, the recharge scheme is uneconomical. (USGS)
W84-00989

NUMERICAL SIMULATION OF GROUNDWATER FLOW IN THE LOWER SATUS CREEK BASIN, YAKIMA INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA.. Water Resources Div.
E. A. Prych.
USGS Water Resources Investigations Report 82-4065, 1983. 78 p, 30 Fig, 17 Tab, 16 Ref.

Descriptors: *Groundwater, *Computer models, Waterlogging, Groundwater basins, Groundwater management, Canal seepage, Drawdown, *Geohydrology, Satus Creek, Lower Satus Creek basin, *Washington, Yakima Indian Reservation.

A multilayer numerical model of steady-state ground-water flow in lower Satus Creek basin was constructed, calibrated using time-averaged data, and used to estimate the long-term effects of proposed irrigation-water management plans on ground-water levels in the area. Model computations showed that irrigation of new lands in the Satus uplands would raise ground-water levels in lower Satus Creek basin and thereby increase the size of the waterlogged areas. The model also demonstrated that pumping water from wells, reducing the amount of irrigation water used in the lowlands, and stopping leakage from Satus No. 2 and 3 Pump Canals were all effective methods to alleviate present waterlogging in some parts of the basin and to counteract some of the anticipated ground-water-level rises that would be caused by irrigating the uplands. The proposed changes in water use affected model-computed ground-water levels most in the eastern part of the basin between Satus No. 2 and No. 3 Pump Canals. The effects on ground-water levels in the western part of the basin between Satus Creek and Satus No. 2 Pump Canal were smaller. (USGS)
W84-01010

4C. Effects On Water Of Man's Non-Water Activities

MODEL MODIFICATIONS FOR SIMULATION OF FLOW THROUGH STRATIFIED ROCKS IN EASTERN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
J. O. Helgesen, S. P. Larson, and A. C. Razem.
USGS Water-Resources Investigations 82-4019, 1982. 109 p, 6 Fig, 6 Ref.

Descriptors: *Computer models, Perched groundwater, *Groundwater flow, Perched springs, Surface-groundwater relations, *Ohio, Computer programs, Three dimensional flow.

A quasi three-dimensional groundwater flow model is being used as part of a study to determine impacts of coal-strip mining on local hydrologic systems. Modifications to the model were necessary to simulate local hydrologic conditions properly. Perched water tables required that the method of calculating vertical flow rate be changed. A head-dependent spring-discharge function and a head-dependent stream aquifer-interchange function were added to the program. Modifications were also made to allow recharge from precipitation to any layer. The modified program, data deck instructions, and sample input and output are presented. (USGS)
W84-00773

EFFECT OF URBANIZATION ON THE WATER RESOURCES OF WARMINSTER TOWNSHIP, BUCKS COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W84-00774

PROCEDURES FOR ASSESSMENT OF CUMULATIVE IMPACTS OF COAL MINING ON THE HYDROLOGIC BALANCE,
Geological Survey, Reston, VA. Water Resources Div.
A. M. Lumb.
Available from the OFSS, USGS, Lakewood, CO 80225, Paper copy $7.25, Microfiche $3.50. USGS Open-File Report 82-334, 1982. 50 p, 12 Fig, 10 Tab, 44 Ref.

Descriptors: *Mine drainage, *Environmental effects, *Simulation analysis, Hydrologic models, Hydrologic budget, Cumulative impacts, Hydrologic consequences.

Techniques were developed to assess the probable cumulative impacts of anticipated surface mining upon the hydrology of and area. An activity profile of cumulative drainage area versus river miles downstream from the surface mining site is constructed that shows major water uses, flood prone areas, and stream classifications. From the summary shown by the activity profile, an impact matrix is used as a checklist for the importance of the impacts under categories such as water supply, flood prone areas, water contact recreation, etc. Based on the categories checked on the impact matrix, a simple, less accurate model or a more comprehensive and accurate one can be used to quantify the impacts. Quantified impacts are then displayed on an impact profile showing the percentage change in a hydrologic characteristic versus distance downstream of the surface mining site. The simple model for quantification considers only dilution from tributary areas during critical periods whereas the comprehensive model routes flows and quality of water continuously through the year and considers, in addition to dilution, instream processes such as settling, biological uptake, and chemical reactions. (USGS)
W84-00780

EFFECTS OF URBANIZATION ON THE MAGNITUDE AND FREQUENCY OF FLOODS ON SMALL STREAMS IN TENNESSEE-BASIC DATA REPORT NO. 2,
Geological Survey, Nashville, TN. Water Resources Div.
C. H. Robbins.
Available from the OFSS, USGS, Lakewood, CO 80225; Price: $3.50 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-911, 1982. 25 p, 1 Fig.

Descriptors: *Floods, *Small watersheds, *Hydrologic data, Peak discharge, Gaging stations, Flood peaks, Basin characteristics, *Tennessee.

Peak stages, discharges, and rainfall recorded at 22 gaging stations on streams draining small (less than 25 mi super 2) urbanized basins across Tennessee

are presented. The gaged basins are in 17 different municipalities with populations ranging between 5,000 and 100,000. The report gives a description of each gaged site along with a data sheet on which peak stages, discharges, and corresponding rainfall are listed. The description gives the station location, type of gage, basin characteristics, and general remarks. (USGS)
W84-00826

CANE CREEK FLOOD-FLOW CHARACTERISTICS AT STATE ROUTE 30 NEAR SPENCER, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
C. R. Gamble.
USGS Open-File Report 83-267, 1983. 12 p, 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Floods, *Flood profiles, High water mark, Step-backwater routing, Flow through bridges, *Tennessee, Spencer.

The Tennessee Department of Transportation has constructed a new bridge and approaches on State Route 30 over Cane Creek near Spencer, Tennessee. The old bridge and its approaches were fairly low, permitting considerable flow over the road during high floods. The new bridge and its approaches are considerably higher, causing different flow conditions at the site. Analysis of the effects of the new bridge, as compared to the old bridge, on floods of the magnitude of the May 27, 1973, flood is presented. The May 27, 1973, flood was greater than a 100-year flood. Analysis of the 50- and 100-year floods for the new bridge are also presented. Results of the study indicate that the new construction will increase the water-surface elevation for a flood equal to the May 27, 1973, flood by approximately 1 foot upstream from bridge. (USGS)
W84-00871

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE COOK CREEK AREA, ASHLAND COAL FIELD, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
M. R. Cannon.
Available from the USGS, OFSS, Federal Center, Lakewood, CO 80225, Paper copy $8.0, Microfiche $4.50. USGS Open-File Report 82-681, August 1982. 30 p, 7 Fig, 3 Tab, 28 Ref.

Descriptors: Hydrology, *Coal mines, *Reclamation, *Water quality, *Montana, Cook Creek, Powder River Basin, *Hydrologic data, *Shallow aquifers, Groundwater.

The Cook Creek area of the Ashland coal field contains large reserves of Federally owned coal that have been identified for potential lease sale. A hydrologic study has been conducted in the potential lease area to describe existing hydrologic systems and to assess potential impacts of surface coal mining on local water resources. Hydrogeologic data collected from wells, springs, and drill holes indicate that shallow aquifers exist within the Tongue River Member of the Fort Union Formation (Paleocene age) and within valley alluvium (Pleistocene and Holocene age). Shallow aquifers within the Tonge River Member include coal beds, clinker, and lenses of sandstone and siltstone. The Knobloch coal bed, a principal shallow aquifer used for livestock watering in the area, averages about 55 feet in thickness and is completely saturated throughout most of its extent. Coarse alluvial deposits are the most productive aquifers and are a major source of stock water in the Cook Creek basin. Surface-water resources are limited to the upstream reach part of Cook Creek, which flows intermittently. The downstream reach part of Cook Creek, plus all other small drainages that originate in the study area, are ephemeral. Mining of the Knoblock and Sawyer coal beds would remove two alluvial springs, one bedrock spring, and two wells, which are all used for watering of livestock. The potentiometric surface within the Knobloch coal aquifer and the alluvial aquifer in the downstream part of the Cook Creek basin would be lowered during mining. Lowered water levels in these aquifers might substantially affect water levels in five wells outside the mine boundary. After mining, the alluvial aquifer downgradient from the mine area might show a long-term degradation in water quality as a result of leaching of soluble salts from overburden materials used to backfill mine pits. Although mining would alter the existing hydrologic systems and remove several springs and shallow wells, alternative groundwater supplies are available that could be developed to replace those lost by mining. (USGS)
W84-00899

PREMINING HYDROLOGY OF THE LIGNITE AREA IN SOUTHEASTERN DE SOTO PARISH, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
J. L. Snider.
Louisiana Department of Transportation and Development, Baton Rouge, Water Resources Technical Report No 29, 1982. 40 p, 11 Fig, 4 Tab, 28 Ref.

Descriptors: *Dewatering, *Groundwater level, *Impaired water quality, *Saline-water intrusion, Sediment basins, *Strip-mine wastes, *Suspended sediments, Coal mining, Groundwater movement, Groundwater recharge, Intermittent streams, Transmissivity, Unconfined aquifers, Water-level fluctuations, Aquifer restoration, De Soto Parish, *Louisiana, Chemard Lake lignite, Dolet Hills aquifer, Low-sulfur lignite, Fault zone, Sand-clay mixing, Sand-grain packing.

Surface mining of the Chemard Lake lignite will affect the ground- and surface-water hydrology in southeastern De Soto Parish, Louisiana. The mining will involve dewatering and removing the Dolet Hills aquifer, which overlies the lignite. This will interrupt local recharge to the aquifer and cause water-level decline near the mined area. After an area is mined the pit will be filled with spoil. The sand from the Dolet Hills aquifer may be impacted without being mixed with clay from the overburden. Under these conditions, the transmissivity of the replaced spoil may be higher initially than that of the original aquifer because of loose packing. In the event that sand and clay in the spoil are intermixed, water movement could be retarded. The major effects on water in streams draining disturbed land would be increased mineralization and increase in sediment load. Mining operators can minimize these problems by storing and treating mine drainage in sediment ponds. (USGS)
W84-01006

IMPACT OF CHANGES IN LAND USE ON THE GROUND-WATER SYSTEM IN THE SEQUIM-DUNGENESS PENINSULA, CLALLAM COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
B. W. Drost.
USGS Water-Resources Investigations Report 83-4094, 1983. 61 p, 29 Fig, 9 Tab, 22 Ref.

Descriptors: Hydrologic budget, *Groundwater recharge, *Aquifer characteristics, Saline water encroachment, Low flow, *Water quality, Clallam County, *Washington, Dungeness River.

A digital-computer model was developed to simulate three-dimensional ground-water flow in aquifers underlying the Sequim-Dungeness peninsula, Clallam County, Washington. Analysis using the model shows that leakage from irrigation ditches is the area's most important source of ground-water recharge. Termination of the irrigation system would lead to lower heads throughout the ground-water system. After 10-20 years of no irrigation, the water-table aquifer would have average drawdowns of about 20 feet and some areas would become completely unsaturated. Several hundred wells could be in danger of going dry. If irrigation were terminated, leakage from the Dungeness River would become the major source of ground-water recharge. As of June 1980, ground-water quality has apparently not been affected in the study area by the use of on-site domestic sewage-disposal systems. The median nitrate-plus-nitrite (as N) concentration in the water-table aquifer was 0.25 milligrams per liter, and the maximum concentration was 2.5 milligrams per liter. (USGS)
W84-01014

GROUND WATER-SURFACE WATER RELATIONSHIPS IN THE BONAPARTE CREEK BASIN, OKANOGAN COUNTY, WASHINGTON 1979-80,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2A.
W84-01017

CHANGES IN FLOOD RESPONSE OF THE RED RIVER OF THE NORTH BASIN, NORTH DAKOTA-MINNESOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
J. E. Miller, and D. L. Frink.
Available from the OFSS, USGS, Lakewood, CO 80225; Paper copy $21.50, Microfiche $3.50. USGS Open-File Report, August, 1982. 158 p, 17 Fig, 13 Tab, 66 Ref.

Descriptors: *Flooding, *Land drainage, *Land use, River basins, Streamflow, Streams, *Red River of the North, Runoff processes, Hydrologic analysis, *North Dakota, Minnesota.

The magnitude and frequency of large floods that have occurred in recent years in the Red River basin have caused concern that land-use changes and manmade drainage have increased flooding. This study was undertaken to determine if any changes in flood response of the Red River basin can be documented. A review of the hydrologic setting, previous floods, flood control measures, and probable effects of land-use changes shows that the flooding problems of the Red River basin is complex hydrologically, highly variable historically, and follows a regional pattern. Therefore, a change in flood response of the basin is difficult to identify. The flood-frequency, regression, normalized-hydrograph, and double-mass analyses show little indication of significant change in flood response of the Red River basin at locations on the main stem. However, the large variation in flood discharges may mask or dwarf small changes in response of the basin. (USGS)
W84-01020

RESERVOIR-DEVELOPMENT IMPACTS ON SURFACE-WATER QUANTITY AND QUALITY IN THE YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
D. B. Adams, D. P. Bauer, R. H. Dale, and T. D. Steele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-127299, Price codes: A06 in paper copy, A01 in microfiche. USGS Water-Resources Investigations Report 81-30, 1983. 98 p, 51 Fig, 14 Tab, 49 Ref.

Descriptors: *Colorado, *Computer models, Model studies, *Reservoir storage, Salinity, Energy budget, Temperature, Diversion, Diversion losses, *Wyoming, Yampa River basin, Mathematical models, Reservoir operation, Multiple-purpose reservoirs, Irrigation water, Water quality, Heat budget, Stratification, Heat transfer, Irrigation practices, Water management, Water utilization, Consumptive use, Diversion-loss returns.

Development of coal resources and associated economy is accelerating in the Yampa River basin in northwestern Colorado and south-central Wyoming. Increased use of the water resources of the area will have a direct impact on their quantity and quality. As part of 18 surface-water projects, 35 reservoirs have been proposed with a combined total storage of 2.18 million acre-feet, 41% greater than the mean annual outflow from the basin. Three computer models were used to demonstrate methods of evaluating future impacts of reservoir

development in the Yampa River basin. Four different reservoir configurations were used to simulate the effects of different degrees of proposed reservoir development. A multireservoir-flow model included both within-basin and transmountain diversions. Simulations indicated that in many cases diversion amounts would not be available for either type of diversion. A corresponding frequency analysis of reservoir storage levels indicated that most reservoirs would be operating with small percentages of total capacities and generally with less than 20% of conservation-pool volumes. Simulations using a dissolved-solids model indicated that extensive reservoir development could increase average annual concentrations at most locations. Simulations using a single-reservoir model indicated no significant occurrence of water-temperature stratification in most reservoirs due to limited reservoir storage. (USGS)
W84-01042

4D. Watershed Protection

STREAMFLOW AND SUSPENDED-SEDIMENT TRANSPORT IN GARVIN BROOK, WINONA COUNTY, SOUTHEASTERN MINNESOTA HYDROLOGIC DATA FOR 1982,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2J.
W84-00832

WATER-QUALITY AND FLUVIAL-SEDIMENT CHARACTERISTICS OF SELECTED STREAMS IN NORTHEAST KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2J.
W84-01045

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

ADVANCE IN WATER QUALITY MONITORING AND THE USE OF FIREFLY LUCIFERINE/LUCIFERASE ATP BIOASSAY,
Science Applications, Inc., La Jolla, CA.
For primary bibliographic entry see Field 5D.
W84-00769

DETERMINATION OF ULTIMATE CARBONACEOUS BOD AND THE SPECIFIC RATE CONSTANT (K SUB 1),
Geological Survey, Urbana, IL. Water Resources Div.
J. K. Stamer, J. P. Bennett, and S. W. McKenzie.
USGS Open-File Report 82-645, 1983. 21 p, 7 Fig, 1 Tab, 8 Ref.

Descriptors: *Oxygen demand, *Biochemical oxygen demand, Dissolved oxygen, *Wastewater treatment, *Time-series analysis, Pollutant identification, *Ultimate biochemical oxygen demand, *Carbonaceous biochemical oxygen demand, *Chemical nitrifying inhibitors, Rate of carbonaceous oxygen demand, First-stage biochemical oxygen demand.

Ultimate carbonaceous biochemical oxygen demand and the specific rate constant at which the demand is exerted are important parameters in designing biological wastewater-treatment plants and in assessing the impact of wastewater in receiving streams. An analytical method is presented which uses time-series concentrations of biochemical oxygen demand, defined as the calculated sum of dissolved oxygen losses at each time of measurement, for determining the two parameters. Two-series measurements of dissolved oxygen are obtained from a water sample that is incubated in darkness at 20 degrees Celsius in the presence of nitrapyrin, a chemical nitrification inhibitor. Time-series concentrations of biochemical oxygen demand that approximate first order kinetics can be analyzed graphically or mathematically to compute the two parameters. (USGS)
W84-00805

QUALITY ASSURANCE PRACTICES FOR THE CHEMICAL AND PHYSICAL ANALYSES OF WATER AND FLUVIAL SEDIMENTS,
Geological Survey, Lakewood, CO.
L. C. Friedman, and D. E. Erdmann.
Available from the Eastern Distribution Br. USGS, 604 S. Pickett St. Alexandria, VA 22304. USGS Techniques of Water-Resources Investigations, Book 5, Laboratory Analysis, Chapter A6, 1982. 181 p, 35 Fig, 40 Tab, 71 Ref.

Descriptors: *Quality control, Statistical methods, Evaluation, *Analytical techniques, *Instrumentation, Test procedures, Documentation, Data collection, Measurement, *Water analysis, Reliability, Water quality control, Data storage and retrieval, Chemical analysis, Biological properties, Materials testing, Charts, Sampling.

This manual contains practices used by the U.S. Geological Survey to assure the quality of analytical data for water, fluvial sediment, and aquatic organisms. These practices are directed primarily toward personnel making water-quality measurement. Some detail specific quality control techniques, others document quality assurance procedures being used by the Central Laboratories System of the U.S. Geological Survey and still others describe various statistical techniques and give examples of their use in evaluating and assuring the quality of analytical data. The practices are arranged into eight sections: Analytical Methods Development Procedures; Standard Quantitative Analysis Techniques; Instrumental Techniques; Reference Material; Laboratory Quality Control; Quality Assurance Monitoring; Documentation, Summary, and Evaluation of Data; and Materials Evaluation. Each section is preceded by a brief description of the material covered. Similarly within each section, each practice is preceded by a description of its application or scope. (USGS)
W84-00812

ANALYSIS OF WATER SAMPLES FOR TOXIC VOLATILE ORGANIC COMPOUNDS: STATE OF THE ART METHODS AND STRATEGIES FOR SAMPLING,
New Mexico State Univ., Las Cruces. Dept. of Chemistry
G. A. Eiceman.
Proceedings of Twenty-eighth Annual New Mexico Conference, 'Water Quality in New Mexico,' April 5-6, 1983. WRRI Report No 169, New Mexico Water Resources Research Institute, Las Cruces, June 1983. p 170-185, 6 Fig, 12 Ref.

Descriptors: *Volatile solids, *Chemical wastes, *Vapor pressure, *Gas chromatography, *Toxicity, *Hazardous wastes, *Poisons, *Surveys, Chromatography, Water sampling, Testing procedures, Water resources institutes, Water quality standards, Rivers.

Rapid development of advanced analytical methods for determining toxic volatile organic compounds (VOC) in water coincided with their discovery in river and drinking water, however, evidence of interest in this subject dates from the early 1950s. Methods of analysis of water for VOC were refined throughout the 1970s so that today rapid analysis of aqueous samples for complex mixtures of VOC at parts per billion concentration ranges are relatively rapid and inexpensive. There were three major technical limitations relative to VOC in water in the mid-1970s. They were: (1) the volatile and, thus, transient nature of VOC during sample handling, (2) an aqueous matrix which may be considered deleterious to expensive analytical instrumentation, and (3) the presence of VOC at microgram per liter concentration levels in sometimes complex mixtures. Vapor pressure studies show that not all small molecules have identical vapor pressure, and small changes in molecular structure, such as the presence of polar bonds (O-H in ethanol versus nonpolar O-CH2CH3 in ether) lead to startling differences in vapor pressure. Because VOC are often found in mixtures rather than isolated species, and because molecule-specific detectors do not exist, gas chromatographic methods are ideal to physically separate individual component in a sample before measurement using a detector. A model for loss of VOC from the Tennessee River was developed and tested, which can be used to make decisions on the best placement of sampling sites. (Garrison-Omniplan)
W84-00851

QUALITY-ASSURANCE DATA FOR ROUTINE WATER ANALYSIS IN THE LABORATORIES OF THE U.S. GEOLOGICAL SURVEY: 1981 ANNUAL REPORT,
Geological Survey, Denver, CO. Water Resources Div.
D. B. Pearst, and N. Thomas.
USGS Water-Resources Investigations Report 83-4090, 1983. 112 p, 184 Fig, 5 Tab, 7 Ref.

Descriptors: Alkalinity, *Chemical analysis, Chlorophyll a, Dissolved solids, *Heavy metals, Nitrogen compounds, Phosphorus, Specific conductivity, Statistics, *Trace elements, *Trace metals, *Water analysis, *Quality-assurance data.

The U.S. Geological Survey maintains a quality-assurance program based on the analysis of reference samples for its two water-analysis laboratories located in Atlanta, Georgia and Denver, Colorado. Reference containing inorganic constituents are prepared at the U.S. Geological Survey's Ocala, Florida, office and disguised as routine samples, and sent daily to each laboratory through other U.S. Geological Survey offices. The results are permanently stored in the National Water Data Storage and Retrieval System (WATSTORE), the U.S. Geological Survey's data base for all water data. These data are analyzed statistically for precision and bias. The results of these statistical analyses are presented for data collected during the 1981 calendar year. In addition, one sample containing known concentrations of trihalomethanes and samples containing unknown concentrations of chlorophyll a were analyzed in both laboratories, and these results also are presented. (USGS)
W84-00897

SPECIFIC IDENTIFICATION OF ORGANIC POLLUTANTS IN HAW RIVER WATER USING GAS CHROMATOGRAPHY/MASS SPECTROMETRY,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
A. M. Dietrich, D. S. Millington, and R. F. Christman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140524, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 206, August 1983, Raleigh, NC. 130 p, 20 Fig, 23 Tab, 3 Ref, 1 Append. A-127-NC(1), 14-34-0001-2135.

Descriptors: *Water pollution, *Rivers, *Organic compounds, *Pollutant identification, *Gas chromatography, *Mass spectrometry, Water quality, Water sampling, Organic pesticides, Phosphorus compounds, Industrial wastewater, Municipal wastewater, Wastewater disposal, Sample preparation, Resins, Mass spectra, Trace levels.

This study investigated organic pollution in the Haw River of North Carolina utilizing current advanced methods for extraction and concentration of aqueous trace organic pollutants combined with identification by Gas Chromatography/Mass Spectrometry (GC/MS). During the one and one-half year study, fifty-two different trace organics were detected in water in samples taken from three sampling sites on the Haw River. The sampling site at the Town of Haw River, located in the industrialized Piedmont, contained the greatest number of trace organic compounds. The sampling site at Bynum, downstream from the Town of Haw River, contained fewer compounds and were frequently the same compounds as those identified at the Town of Haw River site. Water analyzed from Oak Ridge, located upstream from the Town of Haw River, contained the fewest trace organic

contaminants and these pollutants were chemically dissimilar to those found at the other two sites. A trace organic pollutant profile of the Haw River has emerged from this work. The fifty-two organic pollutants detected and identified were determined to be in low microgram/liter (ppb) concentrations, although they contained only three priority pollutants. This data should not be interpreted as a survey or monitoring study of organic composition of the Haw River, since few sampling sites were involved and the purpose was focused on evaluating analytical methodology.
W84-00959

5B. Sources Of Pollution

RECONNAISSANCE FOR DETERMINING EFFECTS OF LAND USE AND SURFICIAL GEOLOGY ON CONCENTRATIONS OF SELECTED ELEMENTS ON STREAMBED MATERIALS FROM THE COAL MINING, REGION, SOUTHWESTERN INDIANA, OCTOBER 1979 TO MARCH 1980,
Geological Survey, Indianapolis, IN. Water Resources Div.
W. G. Wilber, and R. R. Boje.
USGS Water-Resources Investigations 82-4013, Nov. 1982. 39 p, 2 Fig, 6 Tab, 40 Ref.

Descriptors: *Bottom sediments, *Coal mining, *Heavy metals, *Indiana, *Land use, Particle size, *Statistical analysis, Streambeds, *Analysis of variance, Agricultural watersheds, Forest watersheds, Trace elements.

Streambed materials were collected in October 1979 from 69 watersheds in Southwest Indiana having predominantly forested, agricultural, reclaimed, and unreclaimed mined land use to determine whether concentrations of sorbed and acid-soluble metals and trace elements were affected by land use and surficial geology. Analysis of variance indicated that 10% or more of the total variation in aluminum, arsenic, cobalt, iron, nickel, selenium, and zinc concentrations on streambed materials was accounted for by differences in land use. Concentrations of aluminum, cobalt, iron, nickel, selenium, and zinc on streambed materials smaller than 0.062-millimeter from mined watersheds were significantly greater than the concentrations of these elements on streambed materials from agricultural and forested watersheds. The greater concentrations of these elements on streambed materials are due to (1) their concentrations in mine drainage and their subsequent absorption and (or) copecipitation with the oxides and hydroxides of aluminum and iron and (2) their concentrations in coal and pyritic material in streambed materials. (USGS)
W84-00771

EFFECT OF URBANIZATION ON THE WATER RESOURCES OF WARMINSTER TOWNSHIP, BUCKS COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
R. A. Sloto, and D. K. Davis.
USGS Water-Resources Investigations 82-4020, Jan. 1983. 72 p, 20 Fig, 16 Tab, 28 Ref.

Descriptors: *Urbanization, *Groundwater, *Organic solvents, *Water pollution sources, Lead, Trichloroethylene, Tetrachloroethylene, *Pennsylvania, Bucks County, Montgomery County.

Rapid suburban development occurred in Warminster Township after World War II, resulting in a large population dependent on groundwater. A stream-gain-and-loss study showed that losses from Little Neshaminy Creek were equal to 57% of the water pumped from wells near the stream. Groundwater infiltration to sewers was about 850 million gallons in 1979, and about 250 million gallons in 1980. In a year with average precipitation, (45 inches), evapotranspiration is about 24 inches and recharge about 11 inches. As much as 1.1 million gallons per day of additional water may be attached by drilling and pumping wells in areas not now affected by groundwater pumping. Contamination by volatile organic compounds has caused the water from some wells to be unsuitable for public supply. The median concentration of lead in groundwater, 17 micrograms per liter, is above the national median concentration. The concentration of most dissolved constituents increased in water from seven wells sampled at the onset of urbanization in 1953 and 1956 and again in 1979. Effluent from sewage treatment plants has degraded the chemical quality of stream at low flow. (USGS)
W84-00774

STATUS OF GROUND WATER QUALITY IN LOGAN TOWNSHIP, GLOUCESTER COUNTY,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
L. R. Miller, H. Kachroo, S. Andres, and R. Riccio.
Report, February 1982. 158 p, 6 Fig, 4 Tab, 9 Ref, 1 Append.

Descriptors: *Water quality, *Industrial wastes, *Pollutants, *Organic wastes, *Groundwater pollution, *Water pollution sources, Confined aquifers, Groundwater movement, Water sampling, Chemical analysis, Well water, Test wells.

The New Jersey Division of Water Resources (DWR) evaluated the ground water impacts from four possible industrial sources of contamination in Logan Township. DWR sampled 89 wells. The investigation detected ground water contamination at the Monsanto Chemical Company site, but no off-site contamination can be attributed to Monsanto's operation. Ground water contamination has been present since 1972 at Rollins Environmental Services, a hazardous waste treatment facility. Pollutants have been detected to a depth of approximately 70 feet. However, the samples showed that no private residential wells had been contaminated as a result of Rollins' waste disposal practices. Monitoring wells in the vicinity of Bridgeport Rental and Oil Services and Chemical Leaman Tank Lines detected extremely high concentrations of organic pollutants in both ground water and in a deep well between those two industrial sites. Serious contamination of the shallow, intermediate, and deep ground water zones has been detected at the Chemical Leaman site. Public water supply wells had no detectable levels of organic contaminants. Lead levels in one of the public wells was slightly elevated (53 parts per billion in March 1981) and will be monitored, although none of the industries is considered responsible for this condition. DWR recommended a program for future sampling of ground water in the affected areas. (Fazio-Omniplan)
W84-00782

THE STATE WATER PLAN, SUBBASIN 19, MONONGAHELA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6D.
W84-00785

THE STATE WATER PLAN, SUBBASIN 18, LOWER ALLEGHENY RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-18, July 1982. 186 p, 21 Fig, 49 Tab, 6 Append.

Descriptors: *Surface water, *Water pollution sources, *Acid mine drainage, *Coal mine wastes, *Flood damage, *Raw wastewater, Rivers, Sediment yield, Water pollution control, Stream pollution, Iron, Sulfates, Industrial wastes, *Pennsylvania, Allegheny River.

Major industrial areas, such as Pittsburgh and Johnstown are located along rivers in Pennsylvania's Subbasin 18. In addition to the steel industry, the economy of the subbasin also depends on its minerals, mainly coal, gas, oil, sand, gravel and clay. Acid mine drainage and nutrient enrichment due to inadequately treated municipal and industrial waste discharges are the major water quality problems in the subbasin. The Kiskiminetas River has been depressed by raw sewage discharges in the Vandergrift area; however, this problem should be corrected by the new sewage treatment plant. Proposed abatement projects in the Blacklegs and Loyalhanna Creek watersheds will improve the water quality in both watersheds. North of the Pennsylvania Turnpike nearly every major tributary contributes an acid load from mine drainage areas. This pollution, along with raw sewage discharges, accounts for the severely degraded water quality of Stony Creek. Proposed abatement projects in the area upstream of Hooversville will reduce the acid load by 8,860 pounds/day and clean up more than ten miles of the stream. Watersheds D and E are characterized by high iron and sulfate concentrations. The average sediment yield for the subbasin is about 436,000 tons per year. This is relatively high in comparison to other subbasins and is probably due to past and present mining activities. Subbasin 18 has experienced some of the worst flood damage in the state. Nonstructural solutions will be the most effective means of dealing with remaining flood problems in this subbasin. The area's current total water use of 1,453 mgpd is one of the highest in the state. (Garrison-Omniplan)
W84-00786

THE STATE WATER PLAN, SUBBASIN 20, OHIO RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-20, January 1983. 205 p, 21 Fig, 45 Tab, 6 Append.

Descriptors: *Acid mine drainage, *Stream pollution, *Rivers, *Stream improvement, *Surface water, *Industrial wastes, Sedimentation, Municipal wastes, Dissolved solids, Groundwater pollution, Water pollution effects, Water pollution sources, Mine wastes, *Pennsylvania, Ohio River.

All of subbasin 20 lies within the Appalachian Plateaus Province, an area whose economy is largely based on its minerals. Surface water quality is affected by acid mine drainage, although municipal and industrial wastes also cause some degradation. Groundwater quality is depressed on a regional basis by iron, and in localized areas by landfill leachate and seepaage from waste storage lagoons. The Ohio River is degraded by raw and inadequately treated sewage discharges, as well as by heavy metal concentrations from industrial wastes. Implementation of plans to upgrade treatment plants, and compliance by industries ordered to modify their facilities, will reduce some of this pollution. Both industrial and domestic waste discharges originating in Ohio affect the Mahoning River, a tributary of the Beaver River. Slippery Rock Creek and several of its tributaries are affected by acid mine drainage. The main stem has also experienced some sedimentation problems and high amounts of dissolved solids due to active open pit limestone mining, and strip and deep coal mining activities. A planned abatement project in the watershed will result in 13 miles of main stem being cleaned up, along with 6.5 miles of tributaries and 4.5 miles of main stem being improved. Subbasin 20 has experienced significant flood damage in the last half century because of urbanization and the location of communities along the Ohio and Beaver Rivers and their tributaries. There have been 50 damage centers and 11 damage reaches identified in the subbasin. Total water use is about 1,914 mgd of which 518 mgd is attributed to self-supplied industry, primarily steel manufacturing. (Garrison-Omniplan)
W84-00787

IRON IN GROUND WATERS OF THE MAGOTHY AND RARITAN FORMATIONS IN CAMDEN AND BURLINGTON COUNTIES, NEW JERSEY,
D. Langmuir.
New Jersey Department of Conservation and Economic Development, Water Resources Circular No 19, Trenton, 1969. 49 p, 9 Fig, 4 Tab, 16 Ref, 1 Append.

Descriptors: *Iron, *Hydrogen ion concentration, *Chemical analysis, *Water quality, Areal hydrogeology, *Groundwater pollution, Geohydrology,

Aquifers, Potable water, Dissolved solids, Groundwater recharge, Cations, Anions, Pumpage, Well drilling, *New Jersey, Camden County, Burlington County, Raritan aquifer, Magothy aquifer.

Iron is the major quality problem in potable ground waters of the Magothy and Raritan aquifer system in Camden and Burlington Counties, New Jersey. Most wells tapping the aquifer system in this area yield total iron concentrations in excess of 0.3 milligram per liter. The iron is present primarily as dissolved ferrous iron and as colloidal-sized ferric hydroxide. Four water quality zones are defined in terms of dissolved solids, pH, prevalent chemical character, and iron content as analyzed from groundwater samples from 185 wells. The ground water in zones 1 to 3 is primarily of the calcium-bicarbonate type, whereas in zone 4 it is of the sodium-bicarbonate type. The water quality and geohydrologic data suggest that heavy, long-term pumpage in the vicinity of Philadelphia and adjacent parts of New Jersey has induced the flow of zone 3 ground waters up to seven miles in a northerly direction towards this area since 1900. Adjustment of the ground water within the aquifer system to marked seasonal changes in pumpage may cause local groundwater movement of up to one mile with corresponding changes in iron content. The information will be of interest in the study area to owners of existent wells, waterworks personnel, and persons faced with deciding where to drill new wells likely to yield groundwaters low in iron. (Fazio-Omniplan)
W84-00790

HYDROGEOCHEMISTRY OF THE NEW JERSEY PINE BARRENS,
Battelle Columbus Div., OH.
J. L. Means, R. F. Yuretich, D. A. Crerar, D. J. J. Kinsman, and M. P. Borcsik.
New Jersey Dept. of Environmental Protection Bulletin 76, Trenton, 1981. 107 p, 39 Fig, 18 Tab, 220 Ref, 3 Append.

Descriptors: *Areal hydrogeology, *Areal precipitation, *Running waters, *Chemical analysis, *Iron, *Bacterial analysis, Trace metals, Organic acids, Estuaries, Iron oxides, Iron bacteria, Rainfall, Aluminum, Chemistry of precipitation, Biochemistry, Potable water, *New Jersey, Pine Barrens.

This document summarizes the current level of hydrogeochemical knowledge of the New Jersey Pine Barrens, identifies some basic geochemical processes unique in type and degree to the Pine Barrens' ecosystem, and provides a technical basis for further research in soil and water chemistry and geochemistry. The Pine Barrens rivers are unique in many aspects and differ markedly from the chemistry of the 'world average river.' Many Pine Barrens waters, while potable, have some undesirable characteristics that could be corrected by treatment, such as by charcoal filtration. Polluted ground and river waters would adversely influence the chemistry of the estuarine environment as well. This is particularly critical bècause many species of fish and shellfish live or breed in this habitat, supplying a multimillion dollar industry. The unique and fragile ecosystem of the Barrens is directly dependent upon both the quality and quantity of its ground and surface waters. This delicate balance is now seriously endangered by encroaching suburban sprawl. The results of this study can help predict and measure the effects of encroaching land development. Strict regulations concerning water quality, water supply, and land development are required. The results of the study may be used as a data base for comparison with the hydrochemistry of the entire Atlantic Coastal Plain. (Fazio-Omniplan)
W84-00793

STREAM SURVEILLANCE AND ANALYSIS: SHABAKUNK CREEK AND LITTLE BEAR BROOK WATERSHEDS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., A. W. McIntosh, and J. V. Hunter.
Water Quality Planning Program Report, April 1980, Mercer County, NJ, 85 p, 19 Fig, 12 Tab, 25 Ref, 5 Append.

Descriptors: *Stream pollution, *Water quality, *Biological samples, Watershed management, Water pollution sources, Fish, Ecosystems, Benthic fauna, Macroinvertebrates, Heavy metals, Pollutants, Industrial wastes, Organic wastes, Coliforms, Storm runoff, *New Jersey, Shabakunk Creek watershed, Little Bear Brook watershed.

This report evaluates conditions of water pollution and environmental degradation in the watersheds of Shabakunk Creek and Little Bear Brook, New Jersey. The work was undertaken to determine probable causes of observed adverse conditions and, given sufficient information, to determine preventive or remedial programs. The watershed of the West Branch Shabakunk Creek is highly urbanized and environmentally impacted. The Main Branch Shabakunk and Little Bear Brooks are less seriously polluted although Little Bear may periodically have received discharges of hazardous organic wastes. In both watersheds, biological survey and analysis complemented the data obtained by water quality sampling. Although no known point sources enter the Shabakunk Creek, sections of the creek below developed areas are in poor biological condition, with only a few small fish and pollution-tolerant groups of benthic macroinvertebrates present. Water quality analyses indicated that fecal coliform counts often exceed the New Jersey standard of 200 per 100 ml for FW-2 waters. Scrapings from riffles below the most developed areas contained the highest heavy metal concentrations. The presence of storm water runoff and illegal discharges remains a serious problem. Little Bear Brook apparently receives sewage contamination from residential areas. Mercer County will develop guidelines for stream surveillance and analysis studies for use by other areas designing similar efforts. (Fazio-Omniplan)
W84-00801

MERCER COUNTY STORMWATER TOXICS MANAGEMENT PROJECT: DELAWARE AND RARITAN CANAL CONDUIT SPECIAL STUDY, TRENTON, NEW JERSEY.
Mercer County Planning Div., Trenton, NJ.
New Jersey Department of Environmental Protection and Mercer County Water Quality Planning Program, Final Report, 1982. 115 p, 11 Fig, 28 Tab, 48 Ref, 3 Append.

Descriptors: Water quality, *Water quality management, *Storm runoff, *Storm sewers, *Urban runoff, *Chemical analysis, *Pollutants, Canals, Drainage effects, Drainage water, Biochemical oxygen demand, Hydrocarbons, Heavy metals, Polychlorinated biphenyls, Pesticides, Biological samples, Benthic fauna, Enforcement, *New Jersey, Trenton, Mercer County.

A two year study of stormwater runoff in the Trenton, New Jersey area determined the nature and extent of toxic substances entering the Delaware and Raritan Canal, which is extensively used for boating, fishing, swimming, and drinking water supply. Earlier studies had detected toxic pollutants, such as heavy metals, polychlorinated biphenyls, and pesticides in Canal sediments, which were suspected to be entering the Canal through storm sewer discharges. Physical, chemical, and biological sampling and analyses substantiated the need to properly manage the quality of stormwater runoff entering valued water resources. The methodology was based on Mercer County's earlier 'stream surveillance' studies. The study found concentrations of biological oxygen demand, total hydrocarbons, and heavy metals in urban stormwater runoff similar to those reported in the literature. Cadmium, copper, lead and zinc were the predominant heavy metals found. Highway runoff contained lower levels of contamination than urban stormwater runoff. Stormwater runoff from urban residential as well as industrial and commercial areas contained high levels of contamination. Biological surveys identified the greatest effects of pollution nearest the inlet and outlet of the Trenton Conduit. Concentrations of existing contaminants in sediments appeared to be highly localized. Several monitoring and inspection programs are recommended to track the quality of reclining waters, drinking waters and pollutants. (Fazio-Omniplan)
W84-00802

WATER-QUALITY ASSESSMENT OF THE AMERICAN RIVER, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
M. V. Shulters.
USGS Open-File Report 82-763, December 1982. 66 p, 40 Fig, 11 Tab, 36 Ref.

Descriptors: *Water quality, Water quality standards, *Water use, *California, *American River, *Time trend analyses, Specific conductance, Hardness, Alkalinity, *Urban runoff.

Based on an analysis of water-quality data from more than 168 sites, the American River was found to be of overall good quality and suitable for all beneficial uses specified by the State of California, even though its natural condition has been altered by man's activities in the basin. Time trend analyses indicate an increase in specific conductance (dissolved solids), hardness, and alkalinity over the past 20 years in the lower American River near Sacramento downstream from treated effluent and urban runoff sources. Most violations of specific water quality objectives for the basin have occurred in this segment. Water-quality conditions in the segment are expected to improve in 1982 when sewage treatment facility discharges will be discontinued. Potential water-quality problems in the upper American River basin could result from recreational overuse, improper land-use or poorly managed mining operations. Recreational overuse and increased urban runoff are the principal threats to water quality in the lower American River. Proposed monitoring activities include low-flow investigations on the lower American to measure diurnal variations in water-quality characteristics and studies in the uppper basin to determine the impact of increasing recreation and development as well as the effects of mine discharge. (USGS)
W84-00828

SUBBASINS 14 AND 16, GENESEE RIVER AND UPPER ALLEGHENY RIVER,
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6B.
W84-00838

SUBBASIN 11, UPPER JUNIATA RIVER,
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6B.
W84-00839

SUBBASIN 15, LAKE ERIE,
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6B.
W84-00840

STATE WATER PLAN: SUBBASIN 10, LOWER WEST BRANCH SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6B.
W84-00843

STATE WATER PLAN: SUBBASIN 9, CENTRAL WEST BRANCH SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6B.
W84-00844

STATE WATER PLAN: SUBBASIN 8, UPPER WEST BRANCH SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-9, June 1979. 121 p, 18 Fig, 41 Tab, 6 Append.

Descriptors: *River basins, *Acid mine drainage, *Stream pollution, *Acidic water, *Thermal pollution, *Aquatic habitats, *Water quality, Streams, Rivers, Water policy, Groundwater pollution, Flood control, Flood damage, *Pennsylvania, Upper West Branch Susquehanna River.

Most of the northern half of Subbasin 8 in Pennsylvania is in state ownership, and is primarily state forest land; however, it also includes state game lands and state Parks. The subbasin is described in one of 23 reports being published as a result of initial investigations and studies conducted in connection with the State Water Plan of the Commonwealth. Mining operations have impacted negatively on the land and water resources here. Whereas the upper basin has been left relatively undeveloped and preserved, the lower basin has been scarred and left with acid streams unfit for biologic habitat. As a result, the general water quality of Subbasin 8 is poor. Many of the problems originate in tributaries and headwaters to the West Branch Susquehanna River. Limestone in Watershed B neutralizes the acidity upstream, leaving high concentrations of total dissolved solids from calcium and magnesium in the limestone and from the iron, manganese and sulfates in the coal. Thermal pollution from the Shawville electric power generating plant would be a problem were it not that aquatic life has already been eliminated by the high acidity in the river. There have been incidents of groundwater pollution; better land management practices are needed to reduce such incidents in the future. There are only 295,000 tons of sediment leaving the basin each year, one of the smallest erosion rates in the state. Flood damages are common because of the mountainous terrain. (Garrison-Omniplan)
W84-00845

STATE WATER PLAN: SUBBASIN 7, LOWER SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6B.
W84-00846

STATE WATER PLAN: SUBBASIN 6, LOWER CENTRAL SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6D.
W84-00847

THE PUERCO RIVER: MUDDY ISSUES RAISED BY A MINE WATER DOMINATED EPHEMERAL STREAM,
New Mexico Health and Environment Dept., Santa Fe. Environmental Improvement Div.
B. Gallaher.
Proceedings of Twenty-eighth Annual New Mexico Conference, 'Water Quality in New Mexico,' April 5-6, 1983. WRRI Report No 169, New Mexico Water Resources Research Institute, Las Cruces, June 1983. p 60-68, 9 Fig, 1 Tab, 2 Ref.

Descriptors: *Ephemeral streams, Intermittent streams, *Radioactive wastes, *Uranium, *Dewatering, *Water quality standards, Stream pollution, *State jurisdiction, Legal aspects, Water policy, Water resources institutes, Hazardous materials, *New Mexico, Puerco River.

Increased urbanization and industrialization has caused an increase in the disposal of wastewater in ephemeral watercourses. Because there is minimal in-stream dilution of wastewater, the impacts on ground water may be more severe than from a discharge to a perennial stream. Since 1968, dewatering of underground uranium mines in the Church Rock Uranium Mining District has caused perennial flow in the Puerco River. During 1982, the discharge rate was nearly 5,000 gallons of mine dewatering effluent per minute. Although the quality of water discharged from the mines is regulated, the quality of water in the Puerco River itself is subject to little regulatory control in New Mexico. Because of its ephemeral nature, the Puerco River has no designated uses. Therefore, there are no specific stream standards applicable to that channel except the narrative general standards applicable to all surface waters of the state. Arizona has determined that its segment of the Puerco River should be protected for aquatic life, wildlife, irrigation and livestock. Eighteen numerical standards have been developed for metals, radionuclides and nutrients. A recent report by the Environmental Improvement Division noted that the Puerco River contains levels of radioactivity and certain toxic metals that approach or exceed standards or guidelines designed to protect the health of people, livestock and agricultural crops. Data suggest that no level of improvement in effluent quality would render the river totally suitable for these uses. (Garrison-Omniplan)
W84-00853

HYDROCARBON FUELS IN GROUND WATER--INCREASED AWARENESS AND CONCERN IN NEW MEXICO,
New Mexico Health and Environment Dept., Santa Fe. Environmental Improvement Div.
D. Jercinovic.
Proceedings of Twenty-eighth Annual New Mexico Conference, 'Water Quality in New Mexico,' April 5-6, 1983. WRRI Report No 169, New Mexico Water Resources Research Institute, Las Cruces, June 1983. p 35-47, 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Aromatic hydrocarbons, Pollutants, *Hazardous materials, *Chemical wastes, *Industrial wastes, *Data collection, *Surveys, *Water pollution effects, Lubricants, Oil, Petroleum products, State jurisdiction, *New Mexico.

The New Mexico Environmental Improvement Division (EID) has become increasingly aware of the waste contamination problems associated with the leakage and surface disposal of hydrocarbon fuels, including refined petroleum products such as gasoline, kerosene, gas oil (diesel fuel), fuel oils and lubricating oils. The aromatic hydrocarbons commonly found in gasoline include compounds such as benzene, toluene and xylenes, all of which are extremely soluble in ground water. Sources of contamination are the six active gasoline refineries in New Mexico, which are responsible for transportation of hydrocarbon fuels, storage and handling, and disposal. In June 1982, the EID began to inventory all known or suspected cases of hydrocarbon fuel contamination of ground water as a first step in evaluating statewide impacts. Of the 78 incidents recorded, more than 32% were associated with underground leakage of hydrocarbon fuels from commercial retail outlets. Property damage and aquifer restoration costs have climbed as high as $10 million from a single leaking underground gasoline tank. Preliminary suggestions include periodic tank testing of all underground fuel storage tanks, requiring hydrocarbon fuels or hydrocarbon fuel-contaminated water to be discharged into lined evaporation ponds, prompt reporting of all losses to local or central EID offices, and accurate daily inventories of all stored fuels. (Garrison-Omniplan)
W84-00854

GROUND WATER QUALITY IN THE SOUTH OF ALBUQUERQUE,
New Mexico Health and Environment Dept., Santa Fe. Environmental Improvement Div.
D. M. McQuillan.
Proceedings of Twenty-eighth Annual New Mexico Conference, 'Water Quality in New Mexico,' April 5-6, 1983. WRRI Report No 169, New Mexico Water Resources Research Institute, Las Cruces, June 1983. p 48-59, 1 Fig, 4 Tab, 11 Ref.

Descriptors: *Groundwater pollution, *Evapotranspiration, *Chemical wastes, *Ions, *Minerals, *Organic wastes, *Groundwater contamination, Water table, Water quality, Selenium, Strontium, Uranium, Vanadium, Water pollution effects, *New Mexico, Albuquerque, South Valley.

Ground water quality problems in the Albuquerque South Valley date back to at least 1927. Possible causes for these problems include evapotranspiration, contaminant discharges and naturally occurring, water-soluble materials. A study by the New Mexico Environmental Improvement Division (EID) of water samples from two municipal supply wells in San Jose found two sources of chlorinated two-carbon compounds and one source of diesel oil. Potential sources of the organic compounds include chemical and petroleum product handling facilities, manufacturing or processing establishments, sewer lines, dumps and domestic products such as septic tank and cesspool cleaning solvents. The San Jose area has been designated the state's top priority 'superfund' site. Also, the city of Mountainview's excessively mineralized ground water has caused water supply problems since 1961. The worst cases historically show several hundred mg/l of nitrate-nitrogen and calcium, with most other major ions also at high concentration. Bicarbonate levels, however, are relatively low, e.g., 151 mg/l. Recently sampled well waters contained anomalously high levels of selenium, strontium, uranium, vanadium and chemical oxygen demand. The causes of the Mountainview problem remain a mystery. Regarding other sites in the state, gasoline has been found floating on ground water at two locations near U.S. Hwy. 85, where the ground water depth is only ten feet or less. The Pajarito area has reported elevated nitrate levels. (Garrison-Omniplan)
W84-00856

GEOHYDROLOGIC RECONNAISSANCE OF DRAINAGE WELLS IN FLORIDA--AN INTERIM REPORT,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W84-00865

A PLAN FOR HYDROLOGIC INVESTIGATIONS OF IN-SITU OIL SHALE RETORTING NEAR ROCK SPRINGS, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-00873

WATER-QUALITY RECONNAISANCE OF THE NORTH DATA COUNTY SOLID-WASTE DISPOSAL FACILITY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. J. McKenzie.
Available from the OFSS, USGS Lakewood, CO 80225, Price $5.50 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-753, 1982. 38 p, 10 Fig, 7 Tab, 18 Ref.

Descriptors: Water quality, *Landfill, *Leachate, Limestone aquifer, Organic decomposition, *Solid waste, Biscayne aquifer, Nitrification, Chloride indicator, Alkalinity, Electrical resistivity survey, *Florida, Dade County.

A water-quality sampling reconnaissance of the north Dade County solid-waste disposal facility (landfill) near Carol City, Florida, was conducted during 1977-78. The purpose of the reconnaissance was to determine selected quality characteristics of the surface- and ground-water of the landfill and contiguous area; and to assess, generally, if leachate produced by the decomposition of landfill wastes was adversely impacting the downgradient water quality. Sampling results indicated that several water-quality characteristics were present in landfill ground water at significantly higher levels than in ground water upgradient or downgradient from the landfill. Moreover, many of these water-quality characteristics were found at slightly higher levels at down gradient site 5 than at upgradient site 1 which suggested that some downgradient movement of landfill leachate had occurred. For example, chloride and alkalinity in ground water had average concentrations of 20 and 290 mg/L at background wells (site 1), 144 and 610 mg/L at landfill wells (sites 2 and 4), and 29 and 338 mg/L at downgradient wells (site 5). A comparison of the 1977-78 sampling results with the National Primary and Secondary Drinking Water Regulations indicated that levels of iron and color

in ground water of the study area frequently exceeded national maximum contaminant levels, dissolved solids, turbidity, lead, and manganese occasionally exceeded regulations. Concentrations of iron and levels of color and turbidity in some surface water samples also exceeded National maximum contaminant levels. (USGS)
W84-00874

RECONNAISSANCE OF STREAM BIOTA AND PHYSICAL AND CHEMICAL QUALITY FROM SELECTED LAND USE ON STREAM BIOLOGY IN THE COAL-MINING REGION, SOUTHWESTERN INDIANA, 1979-80,
Geological Survey, Indianapolis, IN. Water Resources Div.
D. J. Wangsness.
Available from the USGS, OFSS Lakewood, CO 80225, Price $6.00 in paper copy, $3.50 in microfiche. USGS Open-file Report 82-556, August 1982. 43 p, 18 Fig, 3 Tab, 25 Ref.

Descriptors: *Algae, *Aquatic environment, Aquatic habitat, Aquatic insects, Chemical properties, Chlorophyll, Coal mines, *Indiana, Invertebrates, Biological assessment, *Coal hydrology, Periphytic algae.

To help meet the goals of the Surface-Mining Control and Reclamation Act of 1977, the U.S. Geological Survey is assessing the physical, chemical, and biological characteristics of surface water within the coal-mining region of southwestern Indiana. This report discussed benthic-invertebrate and periphytic-algal communities in streams draining homogeneous agricultural, forested, active/reclaimed-mine, and unreclaimed mine watersheds, and relates the biological communities to the physical and chemical characteristics of the streams. Alkalinity and pH were lower and the concentrations of dissolved solids, calcium, magnesium, sodium, potassium, sulfate, iron, manganese, aluminum, and zinc were higher in unreclaimed-mine watersheds than in the other land-use watersheds. Numbers and community diversity of benthic invertebrates were less at sites affected by mining than at agricultural or forested sites, owing to (1) synergistic effects of pH, metals, and unsuitable habitat and (2) lack of colonizing drift organisms because of the small drainage area upstream from the mined area. Only a few organisms, such as the caddisflies Cheumatopsyche and Hydrosyche and the chironomids Chironomus and Cricotopus were found in streams draining mine areas. (USGS)
W84-00876

LAKE PHOSPHORUS LOADING FROM SEPTIC SYSTEMS BY SEASONALLY PERCHED GROUND WATER, PUGET SOUND REGION, WASHINGTON,
Geological Survey, Reston, VA. Water Resources Div.
J. J. Gilliom, and C. R Patmont.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. USGS Open File Report 82-907, 1982. 25 p, 7 Fig, 5 Tab, 35 Ref.

Descriptors: *Lake eutrophication, *Phosphorus, Groundwater contamination, *Septic tanks, Stochastic analysis, Nutrient transport, Puget Sound region, *Washington, Pine Lake.

In a previous study, estimated phosphorus (P) loadings from septic systems to lakes in the Puget Sound region were found to be correlated with the presence of old homes around the lakes. In the present study, we assessed the movement of septic-effluent P in seasonally perched ground water near Pine Lake, a typical glacial-till lake in the region. This ground water occurs in soils overlying less permeable glacial till, which is prevalent around Pine Lake and many other lakes in the area. Water samples were taken from 15 shallow (<1.5 meters) wells installed 10-50 meters downgradient from seven septic systems 20 to 40 years old. The equivalent volumetric fraction of each sample consisting of undiluted effluent was estimated from chloride concentration. Using Monte Carlo analysis to account for the various sources of uncertainty, we found that, though movement of diluted septic effluent to the lake was common, transport of more than 1% of effluent P through the soil was probable ($p > or = 0.5$) for only 4 of 26 samples, was transport of more than 10% of effluent P probable. The highest probabilities of P movement were associated with two samples from a well that was downgradient from a drainfield located at the base of a hillslope depression where perched ground water concentrates and remains for extended periods. All evidence considered, most P loading to Pine Lake from septic systems appears to come from only a few older systems located in areas where perched ground-water flow and associated saturated soil conditions predominate for extended periods during the winter season. (USGS)
W84-00883

GROUNDWATER QUALITY IN NEW JERSEY--AN INVESTIGATION OF TOXIC CONTAMINANTS,
New Jersey Dept. of Environmental Protection, Trenton. Office of Cancer and Toxic Substances Research.
R. K. Tucker.
Report, March 1981. 60 p, 10 Fig, 8 Tab, 101 Ref, 1 Append.

Descriptors: *Chemical wastes, *Pesticide toxicity, *Groundwater pollution, *Groundwater contamination, *Chemical analysis, Water pollution, Hazardous materials, Water quality, Recharge, Poisons, Metals, *New Jersey.

Fifty chemicals in three groups--halogenated volatile organics, chlorinated pesticides and related compounds, and metals--were searched in well water samples throughout New Jersey. A total of 1,118 samples were taken from 670 sites. Although this is a significant sample size, it is a small portion of the more than 16,000 potable wells in the state. One or more of eight volatile organic compounds were found at concentrations above ten parts per billion in 16.6% of the wells tested. Five of the eight chemicals (carbon tetrachloride, chloroform, dichloroethane, tetrachloroethylene, and trichloroethylene) have been established via animal tests as capable of causing cancer and three others (trichloroethane, and the di-and tri-chlorobenzenes) are chemically similar to known carcinogens, but no reliable evidence exists to prove that they are carcinogenic. In 3.1% of the wells in the study, concentrations of one or more of these eight chemicals exceeded one hundred parts per billion, a clearly unacceptable level. It is hypothesized that low level concentrations of volatile organics may occur in wells subject to widespread contamination by a variety of mechanisms, including aerial transport and recharge from surface waters. In contrast, higher levels of contamination occur in a population of wells subject to direct and relatively nearby discharge of pollutants into the ground. Chlorinated pesticides and related compounds, when detected in this study, were usually at very low concentrations. (Garrison-Omniplan)
W84-00912

WATER-QUALITY ASSESSMENT OF THE MERCED RIVER, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
S. K. Sorenson.
USGS Open-File Report 82-450, November, 1982. 46 p, 21 Fig, 4 Tab, 18 Ref.

Descriptors: *Water quality, *Water quality standards, *Water use, *California, Merced River, Lake McClure, McSwain Reservoir.

The Merced River and its major tributaries have been subject of water-quality and water-quantity studies by local, State, and Federal agencies since before 1900. Data have been compiled and analyzed, and even though water-quality problems exist in the basin, the water generally is of good quality for most of the beneficial uses defined by the California State Water Resources Control Board. Water-quality objectives for dissolved oxygen, pesticides, and pH were violated in some parts of the basin. The most likely cause of the dissolved-oxygen and pesticide violations is the return of agricultural irrigation water to the river in the lower 30 miles of the river. Violations of pH objectives occurred only in the upper drainage and were likely due to naturally occurring, poorly buffered water. Water quality is currently being monitored at three stations in the basin by California Department of Water Resources, at one station by the U.S. Geological Survey, and at several sites by the National Park Service. Modifications to the current water-quality monitoring program are proposed to gain further information on dissolved-oxygen fluctuations and pesticide concentrations in the lower river and to investigate nutrient input to Lake McClue. (USGS)
W84-00924

RECONNAISSANCE OF STORMWATER-RUNOFF WATER QUALITY OF THE BIG PINEY CREEK SEGMENT OF THE CEDAR-PINEY WATERSHED, YELL COUNTY, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
J. C. Peterson.
Available from the OFSS, USGS Lakewood CO 80225, Price: $2.75 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-761, May 1982. 14 p, 1 Tab, 12 Ref.

Descriptors: *Water quality, *Small watersheds, *Storm runoff, *Nutrients, Coliforms, Streptococcus, Iron, Manganese, Sediments discharge, *Arkansas, Watershed reconnaisance.

A reconnaissance of the Big Piney Creek watershed was made between June 1981 and January 1982 to assess the water quality of selected streams in the watershed. Streamflow was measured and water samples were collected three times at each of three sites during the study. All samples were collected during periods of stormwater runoff. The water was soft (7 to 20 milligrams per liter of hardness as calcium carbonate) and dissolved-solids concentrations ranged from 36 to 74 milligrams per liter. Suspended-sediment concentrations ranged from 7 to 144 milligrams per liter. The 5-day biochemical oxygen-demands, total-nitrogen concentrations and total-phosphorus concentrations ranged from 1.5 to 6.8 milligrams per liter, 0.54 to 5.8 milligrams per liter, and 0.03 to 0.56 milligram per liter, respectively. Fecal-coliform bacteria were present in large enough concentrations at two of the sites (340 to 490 colonies per 100 milliliters and 1,200 to 6,000 colonies per 100 milliliters) to indicate that the U.S. Environmental Protection Agency criterion for bathing waters and the Arkansas water-quality standard may be exceeded at times. Total-iron concentrations greater than 1,000 micrograms per liter (the U.S. Environmental Protection Agency criterion for protection of freshwater aquatic life) were detected at least once at all sites. (USGS)
W84-00933

NITRATE LOSS FROM AGRICULTURAL DRAINAGE WATERS: IMPLICATIONS FOR NONPOINT SOURCE CONTROL,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
T. C. Jacobs, and J. W. Gilliam.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140581, Price codes: A11 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute Completion Report Nc 209, September 1983. 222 p, 50 Fig, 27 Tab, 34 Ref, 12 Append. OWRT B-129-NC(1), 14-34-0001-0238.

Descriptors: *Denitrification, *Drainage effects, *Buffers, *Agricultural watersheds, *Nitrogen losses, *Nitrogen movement, Nitrates, Soil water movement, Riparian vegetation, Water pollution sources, Fertilizers, Drainage water, Subsurface drainage, Surface runoff, *North Carolina, Coastal plain.

The amount and fate of nitrogen moving from agricultural fields in two watersheds of the North Carolina Coastal Plain were examined. The possible sinks for this nitrogen and their effects on stream concentration were determined. At the Beaverdam Creek watershed where well- and moder-

ately well-drained soils dominate the agricultural fields, nitrogen readily moved from the fields. However, between most fields and the natural streams, there were buffer strips with heavy riparian vegetation. These buffer areas with poorly drained soils resulted in significant losses of nitrate before the water reached the stream. Very narrow buffer strips were effective for this removal and these strips normally line streams on the Middle Coastal Plain. In soils with subsurface drainage entering ditches via tile lines or subsurface flow, the losses of nitrogen to surface waters were much greater. In watersheds of the Upper and Middle Coastal Plain in-stream losses of nitrogen are not sufficient to reduce heavy loading by nonpoint sources. The floodplains, which have a high capacity to reduce nitrate, usually flood in the winter when temperatures are too low for extensive losses. At the Creeping Swamp watershed in the Lower Coastal Plain, a dense clay layer below the surface horizons reduces subsurface drainage losses of water and nitrogen to very low levels.
W84-00965

HYDROGEOCHEMICAL CYCLING IN A WATERSHED-GROUNDWATER SYSTEM: FORT RIVER AND CADWELL CREEK, MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
G. L. Batchelder, R. F. Yuretich, and W. C. Leonard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140607, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 145, Massachusetts Univ., Amherst, September 1983. 80 p, 29 Fig, 7 Tab, 32 Ref. OWRT A-138-MASS(1), 14-34-0001-2123.

Descriptors: *Acid rain, *Acid streams, *Acidic soils, *Alkaline soils, *Cation exchange, *Chemical analysis, Acidic water, Acidity, Alkaline water, Alkalinity, Chemical composition, Erosion, Geochemistry, Glacial soils, Ion exchange, Rainfall-runoff relationships, Soil chemistry, Well data, Watersheds, Domestic water, Fort River, *Massachusetts, Quabbin reservoir.

This study has determined the principal hydrochemical processes in the headwaters of the Fort River near Amherst, Massachusetts and has initiated a detailed analysis of groundwater in Cadwell Creek, a tributary of the Quabbin Reservoir. Incoming precipitation has an average pH of 4.06 and total dissolved solids of approximately 3.5 ppm, although seasonal variations do occur. Over 99% of the incoming H+ ions are being neutralized in the watershed, primarily by cation exchange and silicate weathering reactions. This produces stream water with a pH between 5.2 and 6.0, and total dissolved solids of 25 to 30 ppm. Major cations are leaving the watershed at a rate six times greater than they are entering. Ca super 2+ is removed fastest, followed in order by Mg super 2+, Na+, and K+. The total chemical denudation rate including SiO sub 2 and SO sub 4 super 2- is 6130 kg/km super 2/yr (about 1.5 times greater than that calculated for Hubbard Brook, New Hampshire). Surficial geology controls the specific composition of streamwater in individual subwatersheds. Drainage basins underlain by till are more effective at neutralizing precipitation acidity than those with abundant stratified drift and/or shallow bedrock. A similar relationship is evident in the composition of groundwater in Cadwell Creek. Research is continuing on Cadwell Creek wells.
W84-00967

TRANSPORT MODELING OF AN AGRICULTURAL HERBICIDE, A LABORATORY SIMULATION,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
E. C. McCall, Jr., D. D. Lane, and A. D. Parr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140623, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Contribution No 240, August 1983. 25 p, 11 Fig, 3 Tab, 23 Ref. OWRT A-106-KAN(1), 14-34-0001-2118.

Descriptors: *Herbicide runoff, *Laboratory simulation, *Atrazine, Soil flume, *Agricultural runoff, Clay loam, Rainfall, Transport modeling, Mass transport.

A one-dimensional flow, laboratory soil flume was used to simulate atrazine loss from a field during rainfall runoff events. Liquid atrazine was surface applied at a rate of 3360 g/ha to a Pawnee clay loam soil. Rainfall events of 1.3 cm/hr and 2.5 cm/hr of one hour durations were applied to the soil flume one day after atrazine application. The rainfall was simulated by overland flow only. The flume was 'placed' in upper, middle and lower locations in a 300 m long, 9% slope field. The soil was saturated and allowed to drain to field capacity before the rainfall event. The flume bottom was impervious to prevent infiltration. For this worst case condition, 90% of the atrazine lost was in the runoff water and the majority of the atrazine loss occurred within twenty minutes of the beginning of the runoff events. Thirty-five percent of the atrazine applied was transported from the field for both the 1.3 and 2.5 cm runoff events. No change in the mass transported by the two different intensity runoff events appears to be due to a limit placed on atrazine availability for runoff by the atrazine rate of desorption and dissolution. The desorption, dissolution process appears to be very slow, i. e., much greater than one hour, and thus the antecedent moisture conditions appear to place a finite limit on the atrazine which is available for runoff during a single event.
W84-00969

SITE STUDIES OF DETERMINE THE EXTENT AND POTENTIAL IMPACT OF HERBICIDE CONTAMINATION IN KANSAS WATERS,
Kansas State Univ., Manhattan. Dept. of Systematics and Ecology.
F. deNoyelles, Jr., and W. D. Kettle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140631, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Contribution No 239, September 1983. 37 p, 10 Fig, 8 Tab, 71 Ref, 2 Append. OWRT A-104-KAN(1), 14-34-0001-2118.

Descriptors: *Herbicides, *Toxicant resistance, *Photosynthesis inhibitors, *Phytoplankton, *Macrophytes, Site studies, Aquatic habitats, Atrazine, Cyanazine, Propazine, Matribuzin, Simazine, Experimental ponds, Tailwater pits, Fish ponds, *Kansas.

The triazine herbicides have accounted for nearly one third of the total herbicide usage in Kansas in recent years. It is well known that these herbicides are entering aquatic habitats in Kansas and throughout the Midwest, yet little is known of their effects on the freshwater organisms residing there. This study was undertaken to accumulate data on triazine herbicide concentrations in State waters and to determine the biological impact of the triazines on phytoplankton and macrophyte communities at those sites. To develop baseline data on the biological effects of triazine herbicides, experimental ponds were treated with different levels of atrazine herbicide under highly controlled situations. Atrazine was chosen to represent the triazines because of its physiological effects on a wide variety of terrestrial and aquatic plants and because it is the single most heavily used pesticide in the United States. In the treated experimental ponds, communities of phytoplankton quickly developed which were more resistant to atrazine. Macrophytic vegetation was significantly inhibited in treated ponds. The next phase of the study involved sampling numerous aquatic habitats throughout the State to (1) analyze the concentrations of triazine herbicides (atrazine, cyanazine, metribuzin, and simazine) and to (2) determine if the macrophyte and phytoplankton communities at these sites had been altered by exposure to triazine herbicides. Triazines were detected at many sites and many of those sites were also found to contain phytoplankton communities possessing a degree of resistance to atrazine. Reductions in macrophyte communities were noted in those waters receiving direct runoff from agricultural fields.
W84-00970

HYDROLOGIC EFFECTS OF STORING LIQUIFIED SEWAGE SLUDGE ON STRIP-MINED LAND IN FULTON COUNTY, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5E.
W84-00977

HYDROGEOLOGY OF A LANDFILL OPERATION, PINELLAS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
F. Mario, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-205070, Price codes: A03 in paper copy, A01 in microfiche. USGS Water Resources Investigations 82-30, 1983. 35 p, 14 Fig, 4 Tab, 15 Ref.

Descriptors: *Landfills, Water quality, *Groundwater movement, *Wet lands, Sanitary engineering, Waste disposal, Path of pollutants, Shallow water, *Leachate movement, *Landfill leachate, Specific conductance, Chloride, Chemical oxygen demand, Total organic nitrogen, Ammonia-nitrogen, *Florida, Pinellas County.

The Pinellas County landfill site is on a flat, coastal area characterized by a high water table is subject to tidal flooding. Altitudes within the study area range from 8 to 12 feet above sea level. Three geohydrologic units underlie the landfill site: a surficial aquifer about 19 feet thick composed of sand and shells; a confining bed about 35 feet thick composed of marl and clay; and the Floridan aquifer composed of limestone. The rate of lateral movement of ground water away from the site is about 1.2 feet per year; however, the rate of movement along the boundary of the landfill cells is about 20 feet per year. Vertical movement through the confining layer is about 0.005 foot per year. Landfill operations have not altered surface-water quality. Leachate migration downward into the Floridan aquifer is not indicated, but data do indicate leachate is migrating from the oldest section of the landfill site through the surficial aquifer. Peaks in concentration of selected chemical parameters and flow-rate analysis of water from trenches indicate the possibility of slug-flow leachate. (USGS)
W84-00996

POLYCHLORINATED BIPHENYLS IN HOUSATONIC RIVER SEDIMENTS IN MASSACHUSETTS AND CONNECTICUT: DETERMINATION AND TRANSPORT,
Geological Survey, Boston, MA. Water Resources Div.
C. R. Frink, B. Sawhney, K. P. Kulp, and C. G. Fredette.
Connecticut Agricultural Experiment Station, New Haven, December 1982. 43 p, 12 Fig, 24 Tab, 31 Ref.

Descriptors: *Polychlorinated biphenyls, *Sediment, Transportation, *Distribution, *Riverbeds, *Connecticut, *Massachusetts, Water quality, Suspended sediment, Suspended load, Contamination, Cores, Deposition, Particle size, Lake Zoar, *Housatonic River, Woods Pond, Lake Lillinonah.

Samples of sediment from the Housatonic River in Connecticut and Massachusetts indicate that PCBs have accumulated predominantly in impounded reaches of the river where sediment accumulation is greatest. Distribution of PCBs within the impoundments is controlled by sediment particle size; greatest PCB concentrations are associated with fine-grained sediment. Study results indicate that an estimated total of 22,200 pounds of PCBs are contained in the river sediments, 60% are in Massachusetts, predominantly in the Woods Pond area, and 40% are in Connecticut. In Connecticut, about 29% of the PCBs are in lake Lillinonah, 10% are in Lake Zoar, and the remaining 1% is distributed in small amounts at other areas. The rate of transport of PCBs in the Housatonic River from Massachusetts into Connecticut by suspended sediment is estimated to be 250-500 pounds per year. (USGS)
W84-00999

EVALUATION OF WATER-QUALITY CHARACTERISTICS OF PART OF THE SPOKANE AQUIFER, WASHINGTON AND IDAHO, USING A SOLUTE-TRANSPORT DIGITAL MODEL,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-01001

GENERAL HYDROLOGY AND EXTERNAL SOURCES OF NUTRIENTS AFFECTING PINE LAKE, KING COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2H.
W84-01015

ASSESSMENT OF THE INTERCONNECTION BETWEEN TAMPA BAY AND THE FLORIDAN AQUIFER, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-01019

HYDROLOGY, WATER QUALITY, AND BIOLOGY OF BAPTISTE COLLETTE BAYOU IN RELATION TO THE MISSISSIPPI RIVER AT VENICE, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
C. R. Demas.
Louisiana Department of Transportation and Development, Baton Rouge, Water Resources Technical Report No 31, 1983. 49 p, 14 Fig, 12 Tab, 35 Ref.

Descriptors: Coliform bacteria, Pathogenic bacteria, Streptococcus bacteria, *Benthic fauna, Bottom sediments, Flow patterns, *Trace metals, Pesticides, *Saltwater intrusion, Distributary, Sediment distribution, Tracers, *Water quality, Baptiste Collette Bayou distributary, *Lower Mississippi River, State water-quality criteria, *Louisiana, Venice.

Water quality including suspended sediment, fecal and pathogenic bacteria, and benthic invertebrates were determined from samples collected from Baptiste Collette Bayou distributary and the Mississippi River at Venice from July 1980 to April 1982 to assess the factors that influence water quality and the distribution of bacterial and benthic invertebrate populations within the system. Data on discharge, and time of travel were also collected. Water samples from Baptiste Collette Bayou and the Mississippi River were similar in composition and concentration during periods of moderate flow in the Mississippi River but differed during periods of saltwater intrusion in the river. Minor-element and water-pesticide concentrations were low in both river and bayou samples. Total-coliform counts exceeded Louisiana State Water Quality Criteria for shellfish production 95% of the time for all stations. Pathogenic bacteria were isolated at all sites and possible sources of bacterial input were identified. Corophium, Nereis, Asebellides, and Carinoma were the organisms that occurred most frequently and in greatest numbers from river and bayou samples. Saltwater intrusion and substrate type appear to be the dominant factors influencing the kinds of organisms present and their distribution within the study area. (USGS)
W84-01025

EVALUATION OF SELECTED ONE-DIMENSIONAL STREAM WATER QUALITY MODELS WITH FIELD DATA,
Geological Survey, Bay Saint Louis, MS. Water Resources Div.
S. C. McCutcheon.
Available from the OFSS, USGS, Lakewood, CO 80225, Price $24.25 in paper copy, $4.00 in microfiche. USGS Open-File Report 82-851, 1982. 182 p, 40 Fig, 14 Tab, 45 Ref.

Descriptors: *Computer models, *Water quality, Evaluation, *Hydrological data, *Arkansas River, Chattahoochee River, Willamette River, M.I.T. water-quality model, *Model comparison, QUAL II, USGS Steady-State water-quality model, WQRRS.

The U.S. Geological Survey One-Dimensional Stream Water-Quality Model, QUAL II Stream Water-Quality Routing Model, the U.S. Army corps of Engineers Water Quality for River Reservoir Systems Model, and the M.I.T. Transient Water Quality Network were evaluated and compared using actual water-quality data collected by the U.S. Geological Survey. The field data were taken from steady-state studies of the Chattahoochee River in Georgia, the Willamette River in Oregon, and the Arkansas River in Colorado. The data used to evaluate the models covered a wide range of physical, chemical, and biological conditions. The Willamette River is a large sluggish stream, whereas the Arkansas River is a small dynamic stream. The Chattahoochee River is of moderate size. Each stream has unique water-quality characteristics that test a wide range of model options. (USGS)
W84-01027

CHLOROFORM CONTAMINATION IN PART OF THE ALLUVIAL AQUIFER, SOUTHWEST LOUISVILLE, KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
R. W. Davis, and E. W. Matthers.
USGS Water Supply Paper 2202, 1983. 25 p, 18 Fig, 2 Tab, 4 Ref.

Descriptors: Organic compounds, *Path of pollutants, *Pollutant identification, Soil contamination, Water pollution effects, *Water pollution sources, Groundwater movement, *Chloroform, *Carbon tetrachloride, Rising water levels, Adsorbtion, *Kentucky, Louisville.

A well in alluvium at Louisville, KY., has been yielding water with concentrations of chloroform as high as 34.80 mg/L since July 1975. A spill of 5,000 gallons of chloroform in 1970, 120 ft from the well, is probably the source. The chloroform is adsorbed in the unsaturated zone in the alluvium; the greatest concentrations are near the water table. Lesser amounts of carbon tetrachloride are found with the chloroform. Its source is unknown. The two contaminants were in the unsaturated alluvium until rising ground-water levels caused water to contact them and the water-chloroform mixture began moving down-gradient to the well. High river stages cause a seasonal cycle of water level rise; the raised ground water comes in contact with more chloroform and the chloroform concentration of the well water increases. No carbon tetrachloride has been observed in the well water. (USGS)
W84-01030

QUALITY OF WATER IN LUXAPALLILA CREEK AT COLUMBUS, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
S. J. Kalkhoff.
USGS Open-File Report 82-373, 1982. 38 p, 9 Fig, 2 Tab, 11 Ref.

Descriptors: *Water quality, *Mississippi, Surface waters, Low flow, Metals, Luxapallila Creek, Columbus, Lowndes County.

The results of a water quality study of a short reach of Luxapallila Creek at Columbus, Mississippi, during September 9-12, 1979, indicate that the water is colored (60 units) and has a low dissolved solids content (44 mg/L). The dissolved oxygen concentration, temperature, and pH of the water in Luxapallila Creek changed a slightly downstream through the study reach. The mean specific conductance almost doubled and the five-day biochemical oxygen demand load increased over four times through the study reach. The fecal coliform to fecal streptococcus ration of 3 to 5 samples collected at the downstream site was greater than 4.0, strongly suggesting the presence of human waste. The concentrations of iron and manganese at the downstream site exceeded the U.S. Environmental Protection Agency's criteria for domestic water supplies. High concentrations of iron, manganese, and lead also were present in a bottom material sample at the downstream site. (USGS)
W84-01034

QUALITY OF WATER AND TIME OF TRAVEL IN BAKERS CREEK NEAR CLINTON, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
S. J. Kalkhoff.
USGS Open-File Report 82-427, 1982. 37 p, 9 Fig, 2 Tab, 5 Ref.

Descriptors: *Water quality, *Mississippi, Surface waters, Low flow, Dissolved oxygen, Bakers Creek, Lindsey Creek, Clinton, Hinds County.

Although dissolved-oxygen concentrations remained below 5 milligrams per liter, the water quality in Bakers Creek improved in a 1.8 mile reach downstream of a (source of) wastewater outfall. The mean specific conductance decreased from 670 micromhos per centimeter to 306 micromhos per centimeter. The 5-day biochemical oxygen demand decreased from 19 to 2.8 milligrams per liter. The mean total nitrogen and phosphorus concentrations decreased from 10 to 7.1 milligrams per liter to 1.0 and 0.87 milligrams per liter, respectively. Maximum fecal coliform bacteria decreased from 7200 to 400 colonies per 100 milliliters. The concentrations of mercury (0.4 micrograms per liter), iron (3,400 micrograms per liter) and manganese (1,100 micrograms per liter) at the downstream site contained DDD (2.5 micrograms per kilogram), DDE (2.7 micrograms per kilogram), and DDT (.3 micrograms per kilogram). The average rate of travel through a 1.8-mile reach of Bakers Creek was 0.06 foot per second or 0.04 mile per hour. (USGS)
W84-01035

WATER QUALITY OF THE UPPER VERMILION RIVER, LOUISIANA, APRIL-AUGUST 1980,
Geological Survey, Baton Rouge, LA. Water Resources Div.
D. K. Demcheck, and H. L. Leone, Jr.
Louisiana Department of Transportation and Development, Baton Rouge, Water Resources Technical Report No 30, 1983. 37 p, 8 Fig, 9 Tab, 17 Ref.

Descriptors: Water quality, *Dissolved oxygen, Biochemical oxygen demand, *Conductivity, Trace metals, Ions, Pesticides, Enteric bacteria, *Productivity, Phytoplankton, Benthic fauna, Streamflow, *Louisiana, Upper Vermilion River, Lafayette, Water-quality differences, Bayou Teche.

Analyses of water-quality data collected during 1980 in a reach of the Vermilion River from its headwaters to a point 6 miles downstream from Lafayette, La., indicate that non-point runoff from the upper basin is a major factor in depressed dissolved-oxygen concentrations, high biochemical oxygen demand, and elevated fecal-bacteria concentrations. High flows masked the contributions of point and nonpoint sources in the Lafayette urban area. When flow lessened, waste inputs from the urban area degraded the water quality in the stagnant reach downstream from Lafayette, primarily through accumulations of nutrients, organic carbon, and biochemical oxygen demand. Changes in benthic macroinvertebrate populations and in algal dominance downstream from Lafayette suggest that discharges in the area have a detrimental impact on the already poor water quality of the Vermilion River during periods of low or zero flow. Samples were collected on an event basis from April through August 1980 and analyzed for inorganics, metals, pesticides and other organic compounds, nutrients, biochemical oxygen demand, fecal bacteria, phytoplankton, and benthic invertebrates. (USGS)
W84-01046

5C. Effects Of Pollution

A SURVEY OF THE MUSSEL DENSITIES IN POOL 10 OF THE UPPER MISSISSIPPI RIVER,
Wisconsin Dept. of Natural Resources, Madison.
R. E. Duncan, and P. A. Thiel.
Technical Bulletin No 139, 1983. 14 p, 4 Fig, 2 Tab.

Descriptors: *Mussels, *Water pollution effects, *On-site data collections, *Shellfish, *Wildlife habitats, *Navigable rivers, River beds, Rivers, Water quality, Habitats, Reservoirs, Data collections, *Wisconsin, Mississippi River.

Impoundment, water quality, and other factors have had an impact on the mussel fauna of the Upper Mississippi River. The primary objective of this survey was to quantitatively define the diversity and relative density of the mussel community in Pool 10 of the river. Pool 10 extends from Lock and Dam No. 9 near Lynxville, Wisconsin, to Lock and Dam No. 10 at Guttenberg, Iowa, a total of 32.8 river miles. Of the 309 sites sampled, mussels were found at 224 sites, or 72%. The East Channel near Prairie du Chien, Wisconsin had the richest mussel fauna with an average density of 2.964 mussels per square foot; and only 6% of the sites were nonproductive. The lower end of Pool 10 had the lowest mussel density at 0.655 per square foot and the highest percentage of nonproductive sites, 38%. The mussel density in the main channel border was two times greater than in the main channel and backwater. A total of 12,150 live specimens representing 31 species of freshwater mussels were collected from Pool 10; an additional 7 species were represented only by dead specimens. Threeridge, Amblema plicata, was by far the most abundant mussel species, comprising 52.9% of the catch and having an average density of 0.832 per square foot. (Garrison-Omniplan)
W84-00909

RECONNAISSANCE OF STORMWATER-RUNOFF WATER QUALITY OF THE BIG PINEY CREEK SEGMENT OF THE CEDAR-PINEY WATERSHED, YELL COUNTY, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 5B.
W84-00933

COMPUTER SIMULATION OF PHOSPHORUS CYCLING IN THE SEDIMENT-WATER SYSTEM OF EUTROPHIC LAKES,
Maine Univ. at Orono. Dept. of Mathematics.
For primary bibliographic entry see Field 2H.
W84-00964

SITE STUDIES OF DETERMINE THE EXTENT AND POTENTIAL IMPACT OF HERBICIDE CONTAMINATION IN KANSAS WATERS,
Kansas State Univ., Manhattan. Dept. of Systematics and Ecology.
For primary bibliographic entry see Field 5B.
W84-00970

HYDROLOGY, WATER QUALITY, AND BIOLOGY OF BAPTISTE COLLETTE BAYOU IN RELATION TO THE MISSISSIPPI RIVER AT VENICE, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W84-01025

WATER QUALITY OF THE UPPER VERMILION RIVER, LOUISIANA, APRIL-AUGUST 1980,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W84-01046

5D. Waste Treatment Processes

CLOSED CYCLE TEXTILE DYEING:FULL SCALE RENOVATION OF HOT WASH WATER BY HYPERFILTRATION,
Carre, Inc., Seneca, SC.
For primary bibliographic entry see Field 3A.
W84-00749

ADVANCED TREATMENT OF SECONDARY SEWAGE EFFLUENT BY MEMBRANE PROCESS,
Water Re-Use Promotion Center, Tokyo (Japan).
G. Inoue, H. Ogasawara, C. Yanagi, and Y. Murayama.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 423-434, 7 Fig, 7 Tab, (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: *Reverse osmosis, *Ultrafiltration, Pretreatment, Sewage effluent, Wastewater treatment, *Advanced wastewater treatment, Tertiary wastewater treatment.

The experimental results on advanced treatment of secondary sewage effluent by ultrafiltration (UF) and reverse osmosis (RO) are presented, particularly focused on pretreatment system, operating condition, membrane cleaning system, and product water quality.
W84-00760

HEALTH AND SAFETY ASPECTS OF IRRIGATION OF RAW-EATEN FOOD CROPS WITH REUSED WATER,
Engineering-Science, Inc., Berkeley, CA.
B. Sheikh, P. N. Storrs, J. Jones, J. S. Hsiao, and W. R. Kirkpatrick.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 491-502, 7 Fig, 1 Tab, (Comprising 2nd Vol. Proc. of Int. Congress on Desalination and Water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: Safety, *Land disposal, *Wastewater irrigation, Wastewater forming, Reclaimed water, Wastewater disposal, Municipal wastes, Monterey, Irrigation, California.

The Monterey Wastewater Reclamation Study for Agriculture (MWRSA) has completed its first year of a five-year pilot effort to investigate and to demonstrate feasibility of food crop irrigation with reclaimed municipal effluent. The project comprises a 96-plot field trial for statistical comparison of three water treatments; an eight-hectare commercial scale farm for demonstration of water reclamation for growing lettuce, broccoli, cauliflower, celery, and artichokes; and aerosol study, a virus assay, market studies, and other ancillary investigations. First year results preliminarily indicate that the main hypothesis of the study will prove to be true, i.e. 'raw-eaten food crops irrigated with properly treated municipal wastewater effluent are safe for human consumption'.
W84-00767

ADVANCE IN WATER QUALITY MONITORING AND THE USE OF FIREFLY LUCIFERINE/LUCIFERASE ATP BIOASSAY,
Science Applications, Inc., La Jolla, CA.
N. Malley, and D. L. Henry.
Desalination, Vol 39, Nos 1/2/3, December 1981, p 521-528, 3 Fig, 6 Ref. (Comprising 2nd Vol. Proceedings of Int. Congress on Desalination and water Reuse, Manama, Nov. 29-Dec. 3, 1981).

Descriptors: Desalination, Water treatment, *Wastewater reuse, *Drinking water, Potable water, Bacterial analysis, Firefly luciferien/luciferase, Adenosine triphosphate, *Bioassay.

Recent advances in rapid clinical bacterial quantification in urine have encouraged the development of automated live-time bacterial level monitoring in drinking water and in recycled/reused wastewater. The methodology and instrumentation used in the bacterial ATP determination, were evaluated. Under appropriate assay conditions there is a linear correlation between ATP content and live bacteria. The common indicator, whenever live bacteria is being measured is the responsible respiratory metabolite, Adenosine Triphosphate (ATP), as measured in g/ml per cell (e.g., fecal E. coli = 500,000,000 mu g/cell) that was counted as a bacterial pool indicator labeled as biomass. When this information was coupled to the oxygen uptake rate (automated ionic sensor rapid detector in 60 minutes), the biological oxygen demand (BOD) could be calculated as: BOD = (Constant) (Oxygen Uptake Rate) over (Biomass).
W84-00769

CHEMISTRY AND APPLICATION OF OZONE AND OZONE/UV LIGHT FOR WATER REUSE-II,
Westgate Research Corp., Los Angeles, CA.
E. Leitis, J. D. Zeff, and M. M. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140557, Price codes: A09 in paper copy, A01 in microfiche. Report OWR/RU-83/5, June 1983. U.S. Dept. of the Interior, Bur. of Reclamation, Washington, DC. 155 p, 36 Fig, 40 Tab, 77 Ref, 1 Append. OWRT C-00256-R(No 1436)(1), OWRT 14-34-0001-1436.

Descriptors: UV light, Ozone, UV-ozonation mechanism, Aqueous C-Cl Bond Breaking, Oxidation, Compounds, Degradation, Chlorine compounds, Heavy metal ions, Refractory organics, *Water reuse, Wastewater treatment, Economics, Advanced wastewater treatment, Industrial effluent reuse.

This report describes the continuation of an experimental study to elucidate the chemistry of Ultraviolet light (UV) enhancement of ozone (O sub 3) oxidation of refractory organics in wastewater. The overall purpose of this study is to reduce the fixed and operating costs of removing these constituents prior to water reuse. The study consisted of (1) an investigation of the synergistic effect of ozone and wavelength of UV light in breaking carbon-chlorine bonds (2) evaluation of the UV-ozonation process to oxidize amino compounds (3) survey of heavy metal ion interference in the UV-ozonation system and (4) accumulation of data from bench and pilot plant tests on industrial effluent from a chlorophenol plant in the Northwest. The more important experimental findings showed that (1) 254 nm UV light, having a minor 185 nm component, was superior to 254 nm UV light in enhancing both the rates of carbon chlorine bond breaking and the yield of chloride ions during UV-ozonation of several classes of chlorinated aliphatic model compounds. (2) The pathway of the amino group nitrogen in aromatic amines leading to nitrate ions was outlined and the rates of the disappearance of these amines during ozonation and UV-ozonation estimated. (3) The conditions of heavy metal ion interference in UV-ozonation were ascertained and (4) data from pilot plant experiments were used to calculate the fixed costs and the operating costs for a full scale wastewater treatment plant.
W84-00962

5E. Ultimate Disposal Of Wastes

WATER-QUALITY RECONNAISANCE OF THE NORTH DATA COUNTY SOLID-WASTE DISPOSAL FACILITY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W84-00874

GEOLOGIC AND WELL-CONSTRUCTION DATA FOR THE H-10 BOREHOLE COMPLEX NEAR THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. G. Wells, and S. L. Drellack, Jr.
USGS Water-Resources Investigations Report 83-4124, 1983. 34 p, 3 Fig, 7 Tab, 11 Ref.

Descriptors: Cores, *Boreholes, Geologic units, *Radioactive waste disposal, Drillers logs, *Waste Isolation Pilot Plant, *New Mexico, Eddy County.

The H-10 borehole complex, a group of three closely spaced boreholes, is located 3 1/2 miles southeast of the proposed Waste Isolation Pilot Plant site in west-central Lea County, New Mexico. The geological data presented in this report are part of a site-characterization study for the possible storage of defense-associated radioactive wastes within salt beds of the Salado Formation of Permian age. Each borehole was designated to penetrate a distinct water-bearing zone: H-10a (total depth 1,318 feet) was completed just below the Magenta Dolomite Member of the Rustler Formation of Permian age; H-10b (total depth 1,398 feet) was completed just below the Culebra Dolomite Member of the Rustler Formation; and H-10c (total depth 1,538 feet) was completed below the Rustler Formation-Salado Formation contact. The geologic units penetrated in borehole H-10c are surficial alluvium and eolian sand of Holocene age (0-5 feet); the Mescalero caliche (5-9 feet) and the Gatuna Formation (9-90 feet) of Pleistocene age; formation in the Dockum Group (Chinle Formation, 90-482 feet and Santa Rosa Sandstone, 482-658 feet) of Late Triassic age; and the Dewey Lake Red Beds (658-1,204 feet), the Rustler Formation (1,204-1,501 feet), and part of the Salado Formation (1,501-1,538 feet), all of Permian age. The sections of the Rustler and Salado Formations penetrated by borehole H-10c are complete and contain little or no evidence of dissolution of halite and associated rocks, indicating that the eastward-moving dissolution on top of the Salado, found just to the west of the WIPP site, has not reached the H-10 site. (USGS)
W84-00901

DATA ON SUBSURFACE STORAGE OF LIQUID WASTE NEAR PENSACOLA, FLORIDA, 1963-1980,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00951

HYDROLOGIC EFFECTS OF STORING LIQUIFIED SEWAGE SLUDGE ON STRIP-MINED LAND IN FULTON COUNTY, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
G. L. Patterson.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $4.25 in paper copy, $3.50 in microfiche. USGS Water Resources Investigations Report 82-4047, December 1982. 30 p, 11 Fig, 10 Tab, 5 Ref.

Descriptors: *Groundwater, *Water quality, *Sewage sludge, *Reclamation, Strip mines, Hydrologic models, Water table, Settling basins, Sludge disposal, Fulton County, *Illinois, Sludge irrigation.

The water table near four sewage storage basins in a strip-mined area of western Illinois, has risen about 10 feet since the basins were constructed in 1971. Two dimensional modeling of ground-water flow in the mine spoil indicates that the rise is caused by leakage from one storage basin. The hydrologic-parameter values producing the best fit between computed and observed head values are 0.000007 feet per second for the hydraulic conductivity of the mine spoil, 0.0000000004 feet per second for recharge from the leaking basin. The model indicates the volume of water leaking from the basin is 91,600 cubic yards per year. The principal components of the sewage sludge after the solids have been removed are alkalinity, nitrogen, phosphorous, and chloride. Components in higher concentrations near the basins were sodium, alkalinity, and chloride. Because the sodium and chloride concentrations in the sludge were too low to cause the higher concentrations in the ground water, the strip-mine spoil used in constructing the basins was considered to be the major source of these constituents. This spoil has been moved from its original location and unweathered surfaces exposed, which allowed dissolution of carbonate and chloride and release of sodium through cation exchange. (USGS)
W84-00977

5F. Water Treatment and Quality Alteration

REMOVING URANIUM FROM DRINKING WATER SUPPLIES: DEMONSTRATION OF SELECTED ION EXCHANGE AND CHEMICAL CLARIFICATION,
New Mexico State Univ., Las Cruces. Dept. of Chemical Engineering.
D. B. Wilson.
Proceedings of Twenty-eighth Annual New Mexico Conference, 'Water Quality in New Mexico,' April 5-6, 1983. WRRI Report No 169, New Mexico Water Resources Research Institute, Las Cruces, June 1983. p 193-206, 4 Fig, 6 Tab.

Descriptors: *Uranium, *Water quality standards, *Radioactive wastes, *Ion exchange, *Chemical coagulation, *Chemical flocculation, *Sedimentation, *Filtration, Flotation, Surveys, Water policy, Water resources institutes, Federal jurisdiction.

The proposed standard for uranium has been suggested as 10pCi/l (equivalent to 14.7 micrograms/l). Before establishing this standard, the U.S. Environmental Protection Agency must demonstrate available economical control technology for achieving such a level. This study is being conducted to demonstrate ion exchange and chemical clarification technology. Chemical clarification consists of coagulation, flocculation, and solid-liquid separation, such as sedimentation, flotation and/or filtration. While the mechanism of uranium removal via chemical clarification has not been proved conclusively, it most likely occurs through the adsorption of the uranyl ion complex by the coagulant precipitate. Conventional water treating systems which use chemical clarification employ either rapid-mix basins, flash-mix basins, or in-line mixers. Ion exchange is a separation process in which ions held by electrostatic forces to charged functional groups on the surface of an insoluble solid are replaced by ions of like charge in solution. Ion exchange has been used as a standard unit operation for the commercial recovery of uranium for many years. Graduate students in chemical and civil engineering are assembling the equipment for the chemical clarification evaluation experiments, and the ion exchange equipment is already operating on location. (Garrison-Omniplan)
W84-00857

REMOVAL OF REFRACTORY ORGANICS FROM WATER BY AERATION. II. SOLVENT SUBLATION OF METHYLENE BLUE AND METHYL ORANGE,
Vanderbilt Univ., Nashville, TN. Dept. of Chemistry.
J. L. Womack, J. C. Lichter, and D. J. Wilson.
Separation Science and Technology, Vol 17, No 7, p 897-924, May, 1982. 17 Fig, 18 Ref.

Descriptors: *Separation techniques, *Organic compounds, *Surfactants, *Organic solvents, *Dyes, Theoretical analysis, Pollutant identification, Drinking water, Water analysis, Salts, Solvents, Water treatment.

In solvent sublation, a surface-active solute is transported from the aqueous phase to an overlying layer of a nonvolatile organic liquid on the air-water interfaces of bubbles rising through the solvent sublation cell. This technique has been suggested for removing dissolved substances from aqueous systems. The removal of the refractory organics methylene blue-sodium tetradecylsulfate and methyl orange-hexadecyl-trimethylammonium bromide from water to 2-octanol was carried out by solvent sublation. Three possible mechanisms were examined in the laboratory batch scale experiments. Potassium chloride, sodium nitrate and sodium biphosphate were tried as added salts. The colored species removed for each refractory compound is believed to consist of one ion of dye complexed with two of surfactant. The effects of mass transfer rate in the vicinity of the bubble-water interface were examined theoretically. The empirical time constant for mass transfer was related to the lowest eigenvalue of an appropriate diffusion problem. (Geiger-FRC)
W84-00954

5G. Water Quality Control

THE STATE WATER PLAN, SUBBASIN 17, CENTRAL ALLEGHENY RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6D.
W84-00784

THE STATE WATER PLAN, SUBBASIN 18, LOWER ALLEGHENY RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 5B.
W84-00786

MORRIS COUNTY MASTER PLAN: WATER SUPPLY ELEMENT.
Killman (Elston T.) Associates, Inc., Millburn, NJ.
For primary bibliographic entry see Field 6D.
W84-00788

STATE WATER PLAN: SUBBASIN 5, UPPER CENTRAL SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6B.
W84-00848

STATE WATER PLAN: SUBBASIN 4, UPPER SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6B.
W84-00849

STATE WATER PLAN: SUBBASIN 1, UPPER DELAWARE RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 6B.
W84-00850

POINT SOURCE WASTE LOAD ALLOCATION FOR THE TOWN OF RED RIVER,
New Mexico Health and Environment Dept., Santa Fe. Environmental Improvement Div.
D. F. Tague.
Proceedings of Twenty-eighth Annual New Mexico Conference, 'Water Quality in New Mexico,' April 5-6, 1983. New Mexico Water Resources Institute, Las Cruces, June 1983. p 12-21, 4 Fig, 3 Tab, 1 Ref.

Descriptors: *Waste load, Tertiary wastewater treatment, *Water quality standards, *Water quality criteria, *Surveys, *Water use, Nonpoint pollution sources, *Phosphorus, Stream discharge, Algal growth, Economic aspects, *Wastewater treatment, Secondary wastewater treatment, *New Mexico, Red River.

A point source waste load allocation for municipal discharge was required for the Red River in New Mexico when secondary treatment was not sufficient to meet water quality standards. First, the designated uses were identified and numeric or narrative criteria were determined that were sufficient to preserve the designated uses. A year-long stream and effluent sampling program was conducted. A series of 11 algal assay tests demonstrated that the Red River is a phosphorus-limited aquatic environment. Consequently, the river is exempt from the total inorganic nitrogen standard and a waste load allocation is not required for that constituent. The stream standard for total phosphorus (P) was exceeded on 15 of 21 sampling dates at the station below the treatment works. No other

violations of stream standards were observed at this station. At Station HRG-21, six miles above the town, where the natural quality of the river is represented, the average P concentration is 0.006 mg/liter. Cultural nonpoint sources in and above the town add phosphorus sufficient to raise the river concentration to 0.022 mg/liter, an increase of 3.67 times. Monthly phosphorus limitations were developed that take into account monthly low streamflow and seasonal variations in wastewater flow. The savings in costs of operation to the town of Red River that will result from wastewater treatment requirements for phosphorus and ammonia developed on a seasonal schedule was estimated at more than $200,000 per year. (Garrison-Omniplan)
W84-00855

NONPOINT SOURCES,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 6B.
W84-00916

INDUSTRIAL WASTEWATER,
Texas Univ. at Austin. Dept. of Environmental Engineering.
G. A. Rohlich.
In: Proceedings of the National Water Conference, Water Quality and The Clean Water Act, Philadelphia, January 26 and 27, 1982. Academy of Natural Sciences, Philadelphia, July 1982. p 67-86, 8 Fig, 3 Tab, 9 Ref.

Descriptors: *Industrial wastes, *Manufacturing wastes, *Hazardous materials, *Industrial wastewater, *Water quality standards, *Water quality control, *Industrial plants, Poisins, Industrial production, Legal aspects, Water policy, Public policy, Municipal wastes.

Despite the vast amount of information available, technical solutions to the problem of industrial waste treatment become more complex in view of the inclusion of toxic pollutants in water quality standards and effluent limitations. Data on the performance of available treatment technology for removing many of the toxic constituents is limited or non-existent. Separation of waste streams at the source should be considered so that toxic materials can be segregated and handled independently. Some difficult issues to decide are what types of plants to use, the technical and economic sufficiencies of the facilities, and justifying why a particular type was selected in terms of social and legal constraints. Progress has been made in meeting the legal requirements of the National Pollutant Discharge Elimination System (NPDES). As of February 1980, nearly 59,000 NPDES permits were issued. Of these, 15,395 were to municipalities and 43,512 to non-municipal (mostly industrial) discharges. There has been a steady decline in the number of violations by non-municipal NPDES permit holders: 184 in 1977; 121 in 1978; and 64 in 1979. In the total pollution abatement category, total annual costs in 1979 are estimated to be $7.6 billion in 1979 and $11.5 billion in 1988. Future policies and legislation must place additional emphasis on 'prophylactic rather than therapeutic measures.' (Garrison-Omniplan)
W84-00917

MUNICIPAL WASTEWATER TREATMENT: 1970 AND TODAY,
Water Pollution Control Federation, Washington, DC.
C. F. Guarino.
In: Proceedings of the National Water Conference, Water Quality and The Clean Water Act, Philadelphia, January 26 and 27, 1982. The Academy of Natural Sciences, Philadelphia, July 1982. p 51-65.

Descriptors: *Municipal wastewater, *Industrial wastes, *Municipal wastes, *Legislation, *Federal jurisdiction, *Economic aspects, *Legal aspects, *Lake rehabilitation, Lake reclamation, Wastewater treatment, Water quality standards, Water quality control.

In 1970 the President's Council on Environmental Quality (CEQ) reported our nation needed to invest $10 billion in municipal water treatment and $3.3 billion in industrial control. During that year federal appropriations for research and development in the water pollution control field were increased to $60 million. Federal aid to state programs was set at $10 million. Two significant goals set by Congress were secondary treatment for municipal wastewater treatment authorities by July 1, 1977, and 'fishable, swimmable' waters wherever attainable by July 1, 1983. To date almost $32 billion has been appropriated for the program; $18 million has been spent. Yet the goals were not universally reached. Up to two-thirds of the treatment authorities in the country missed the 1977 deadline. By the end of 1979, heavy metal concentrations were reported by CEQ as the most widespread water quality problem, and 10,000 of some 37,000 public lakes were found to be in need of restoration or pollution control. On the other hand, some clean water successes have occurred in New Hampshire, New Jersey and Texas where fish have returned to formerly polluted waters. The Water Pollution Control Federation believes the EPA needs to devote more attention to questions of performance. Meanwhile, a revision to secondary treatment regulations should be made to allow case-by-case waivers of biochemical oxygen demand and suspended solids requirements or 85% removal criteria, based on water quality justifications. (Garrison-Omniplan)
W84-00918

WHAT IS THE CONDITION OF OUR SURFACE WATER.,
Academy of Natural Sciences of Philadelphia, PA.
R. Patrick.
In: Proceedings of the National Water Conference, Water Quality and The Clean Water Act, Philadelphia, January 26 and 27, 1982. Academy of Natural Sciences, Philadelphia, July 1982. p 11-29, 11 Fig.

Descriptors: *Surface water, *Water quality control, *Water quality standards, *Stream improvement, *Stream pollution, Rivers, Water pollution, Legislation, Swimming, Wildlife habitats, Public policy, Water policy, Sediment load.

A single standard in pollution control cannot be applied throughout the United States because of variances in the natural and chemical characteristics of streams. Most of the streams in the southeastern United States have a dissolved oxygen content lower than 2 to 3 ppm. Likewise, the natural sediment load varies greatly and is particularly heavy in the midwestern and southwestern parts of the United States. Natural causes of high phosphate exist in Florida and some parts of Texas. To be meaningful, regulations should be aimed not only at swimmabiltiy and fish, but also at protecting the microorganisms and smaller macroorganisms in streams and lakes that are important in the recycling of waste and the restoring of water quality. Improvements have occurred in the Ohio River where over 100 successful bass tournaments were held in 1975, something that would never have been considered in 1970. Other improvements have been in the Delaware and Connecticut Rivers, and in streams in Maine, where about 67% were found to be fishable and swimmable. Streams in Massachusetts, Connecticut and Pennsylvania also showed improvement as of 1976. The Potomac River in Washington, D.C., is fishable near the city. Out of 642 small streams in Tennessee, 300 to 346 now meet water standards and 258 more will meet them in 1983. The majority of streams in Minnesota, Nebraska, Kansas and Arkansas will also support fish and wildlife in 1983. (Garrison-Omniplan)
W84-00919

LOCALIZED DESTRATIFICATION AT LAKE TEXOMA,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
K. M. Robinson, J. E. Garton, and R. E. Punnett.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE4, p 739-749, August, 1982. 13 Fig, 2 Tab, 12 Ref. OWRT C-7603(No 7250).

Descriptors: *Destratification, *Reservoir releases, *Mixing, *Lake Texoma, *Oklahoma, *Texas, Water quality management, Intakes, Hypolimnion, Epilimnion, Metalimnion, Stratification, Thermal stratification, Pumps, Turbidity, Sulfides, Manganese, Iron, Phosphorus, Ammonia, Lakes.

The quality of water released from thermally stratified Lake Texoma was improved by use of an axial flow Garton Pump located above the intake structure. The 8 ft diameter, 6-blade propeller pump, mounted on a floating platform, operated a propeller suspended 5.6 ft below the water surface to pump high quality epilimnion water down to the intake. Outlet release rates were varied from 50 to 600 cfs. At the maximum dilution factor of 32.5% the pump/release rate ratio was 0.48. Maximum improvements were: turbidity, 83% at 300 cfs; sulfides, 68% at 50 cfs; manganese, 49% at 150 cfs; total iron, 21% at 300 cfs; phosphorus, 53% at 600 cfs; and ammonia-N, 37% at 150 cfs. Maximum temperature increase was 3.24F at 300 cfs. At the time of the study, August 18, 1980, the epilimnion was 52.5 ft deep and the metalimnion extended from 52.5 to 65.5 ft. Below 59 ft the water was anoxic. (Cassar-FRC)
W84-00956

NITRATE LOSS FROM AGRICULTURAL DRAINAGE WATERS: IMPLICATIONS FOR NONPOINT SOURCE CONTROL,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W84-00965

GRAPHICAL METHOD FOR ESTIMATING OCCURRENCE AND DURATION OF A CRITICAL LOW FLOW IN THE SACRAMENTO RIVER AT FREEPORT, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. G. Harmon.
USGS Water Resources Investigations Report 82-4001, May 1983. 16 p, 1 Tab, 6 Fig, 2 Ref.

Descriptors: *Effluents, Flow duration, *Neap tides, Outfall, *Spring tides, Stages, Streamflow, Unsteady flow, Wastewter treatment, *Low-flow, Sacramento River, *California.

Sacramento County expects to begin operation of the Sacramento Regional Wastewater Treatment Plant in 1982. The California State Water Resources Control Board has ruled that the plant will not be allowed to release effluent into the Sacramento River when flow in the river is 4,000 cubic feet per second or less. Depending on tide condition, flows less than 4,000 cubic feet per second may occur either once or twice during each 24-hour 50-minute tide cycle when the daily mean flow is less than about 12,000 cubic feet per second. Daily means flows less than 12,000 cubic feet per second occur about 28% of the time. Riverflow at the plant outfall is monitored by an acoustic streamflow-measuring system. Regulation of effluent released from the plant will normally be based on real-time flow data computed by the acoustic system. A graphical method for determining the occurrence and duration of flows of 4,000 cubic feet per second and less was developed as a backup system to be used if a temporary failure in the acoustic system occurs. (USGS)
W84-00973

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

INTEGRATING INTERMITTENT AND RENEWABLE POWER RESOURCES INTO THE HYDROPOWER SYSTEM OF THE PACIFIC NORTHWEST,
Washington State Univ., Pullman. Dept. of Computer Science.
C. B. Millham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140516,

Price codes: A06 in paper copy, A01 in microfiche. Water Research Center Completion Report, July, 1983. 118 p, 9 Fig, 24 Tab, 28 Ref, 1 Append. OWRT A-111-WASH(1), 14-34-001-2151.

Descriptors: *Solar water heaters, *Solar pumps, *Wind turbines, *Hydropower simulation, *Computer modeling, Pumped storage, Streamflow contraints, *Pacific Northwest U.S., Columbia River, Snake River, Model studies, Auxiliary hydropower sources.

This report discusses the extent to which hydropower could be used to 'smooth' and back up intermittent and unreliable power sources, including solar water heaters, solar irrigation pumps, and wind-generation turbines. The amounts of power involved in each are developed, and economic evaluations are given. Because the volumes of power are potentially relatively large and because the economics of wind turbines are potentially competitive, the bulk of the work focuses on these units. The tool of analysis is a 51-reservoir, 56-time-period computer simulation model of the hydropower system in the Snake and Columbia Rivers and tributaries.
W84-00958

6B. Evaluation Process

WANAQUE SOUTH PROJECT ECONOMIC FEASIBILITY STUDY, EXECUTIVE SUMMARY.
Bogert (Clinton) Associates, Fort Lee, NJ.
Report submitted to North Jersey District Water Supply Commission, Wanaque, January 1981. 18 p, 1 Fig, 1 Tab.

Descriptors: *Economic feasibility, *Feasibility studies, *Water supply development, *Construction costs, Drought, Computer models, Storage requirements, Watersheds, Pumping plants, Diversion, Spillway gates, Spillway crests, Capital costs, Reservoir sites, *New Jersey, Wanaque South Project.

The northeastern metropolitan area of New Jersey has experienced at least one severe drought in every decade since the turn of the century, except in the 1970's. The Wanaque South Project represents the major step to relieve the threat of a water crisis. The Project joins the Passaic and Hackensack watersheds for the benefit of a region without causing significant problems for any known or planned beneficial use. It may be adapted to provide greater yields by construction of Monksville Reservoir and by diversions from the Raritan, Hudson, or Delaware River Basins. Using computer modeling with draft conditions, the feasibility study determined storage requirements for various assumed yields for historical droughts for two pumping periods, developed two alternative projects, and developed preliminary designs to permit reasonable estimates of construction and operating costs. The permissible pumping period, as determined by stream flow and water quality stipulations of the grant, results in an incremental yield of the Project ranging from 79 to 64 million gallons per day. The advantages of the Wanaque South Project over alternatives studied are in both the reasonable amount of the supply and the costs, which are about 40% of that for other proposed projects per million gallons of dependable yield. (Fazio-Omniplan)
W84-00789

SUBBASINS 14 AND 16, GENESEE RIVER AND UPPER ALLEGHENY RIVER,
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-16, December 1980. 172 p, 19 Fig, 42 Tab, 6 Append.

Descriptors: *Rivers, *Brines, *Leachates, *Water pollution control, *Biodegradation, *Suspended solids, *Dissolved oxygen, Water use, Petroleum products, Sediment yield, Municipal wastes, Industrial wastes, Water treatment, Landfills, Wild rivers, *Pennsylvania, Genesee River, Upper Allegheny River.

The two main water quality problems in Subbasins 14 and 16, the headwater areas of the Upper Allegheny River Basin and the Genesee River Basin, are suspended solids and biodegradable wastes, caused by inadequately treated municipal and industrial waste discharges, and degradation by oil and gas well brines. Tunungwant Creek has high BOD, ammonia, phenol, chlorides and dissolved solids. The planned upgrading of the Bradford treatment facilities will reduce the BOD and ammonia problems. Conewango Creek's main problem is organic suspended material and low dissolved oxygen values which originate upstream in the State of New York. Oil and gas brines are affecting three streams, and sewage discharges at Tionesta are affecting the Allegheny River, but this problem should be alleviated by the proposed Tionesta treatment facilities. Oil Creek has excellent water quality except in the lower two miles, which is severely degraded due to oil pollution and related petro-chemical industrial activities. Incidents of groundwater pollution have occurred as a result of oil production, landfill leachates and industrial waste lagoons. The sediment yield for Subbasins 14 and 16 is 460,000 tons per year. It is recommended that conservation measures be implemented to reduce this problem. Within the subbasin, 22 streams have been designated as candidates for the State Scenic Rivers System. Water supplies within Subbasin 16 are generally abundant, and usage is moderate--175 mgd in 1970. In Subbasin 14, there are only two water suppliers, and both have inadequate supplies to meet existing demands during a drought. (Garrison-Omniplan)
W84-00838

SUBBASIN 11, UPPER JUNIATA RIVER,
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-12, January 1980. 123 p, 18 Fig, 40 Tab, 6 Append.

Descriptors: *Groundwater pollution, *Thermal pollution, *Leachates, *Municipal wastes, *Industrial wastes, *Flood frequency, *Coal mine wastes, *Acid mine drainage, *Wild rivers, Oil pollution, Sediment yield, Soil erosion, Stream pollution, *Pennsylvania, Upper Juniata River.

Subbasin 11 in Pennsylvania typifies the Southern Alleghenies, a rural and sparsely populated area. Most of the population lives in the river valleys, which are prone to damage by flooding. Municipal and industrial development has led to localized water quality problems. Ten reaches of stream are candidates for the Pennsylvania Scenic Rivers System. Water quality problems stem from municipal or industrial waste discharges, malfunctioning on-lot sewage disposal systems, landfill leachate or acid mine drainage. Coal mining occurs to the west and south of Altoona and in Watershed D, which causes acid mine drainage into four streams. The power plant located on the Frankstown Branch Juanita River at Williamsburg causes thermal pollution. However, the plant will be retired soon. On-lot sewage system malfunctions due to inadequate soils are a problem throughout the basin. Groundwater pollution is occuring from septic tanks, landfills, oil tank leaks, seepage from industrial soils. The current sediment yield is 174,000 tons per year; this could be reduced through better conservation practices. With the exception of the Williamsburg Power plant, the largest water supply usage in the basin is for public water supply. Currently 8 of the 42 suppliers would have a source yield deficiency if a drought were to occur. Seven of the companies can meet future yield deficiencies by installing meters, which should reduce the demand. Consumptive water use could be an emerging problem, if crop irrigation during dry years increases. (Garrison-Omniplan)
W84-00839

SUBBASIN 15, LAKE ERIE,
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-15, December 1979. 78 p, 17 Fig, 35 Tab, 6 Append.

Descriptors: *Eutrophic lakes, *Lake soils, *Impaired water quality, *Coliforms, *Urban runoff, *Water pollution sources, *Industrial wastes, *Municipal wastes, *Anaerobic conditions, Water pollution effects, Water pollution control, Dissolved oxygen, Water quality standards, *Pennsylvania, Lake Erie.

The Lake Erie subbasin is one of two areas in Pennsylvania which drains into the Great Lakes and St. Lawrence River. Lake Erie is not only a major factor in the development of the area, but is also a major influence on the climate, making possible better agricultural production than normal for its latitude. Water supply is not a serious problem in Subbasin 15 because the lake provides essentially unlimited amounts of water. A proposed steel plant to be located beside Lake Erie on the Pennsylvania-Ohio State line will strengthen the economy of this region, which includes the manufacturing of electrical and paper products, vineyards, orchards and dairy farms. Lake Erie has had an accelerated eutrophication rate. Pollution from cities as far away as Detroit accumulate in the lake causing decreases in dissolved oxygen and enrichment of aquatic plants. Along the south shore, combined sewer overflows and urban runoff are causing high coliform counts. Correcting the sewer overflow situation should solve most of this problem. All but three of the small streams which drain directly into Lake Erie have high coliform bacteria contamination, and ammonia, iron, phosphate and pH problems due to domestic discharges, septic tank effluents, combined sewer overflows, and urban and agricultural runoff. Deep wells are not possible because of salt water problems. Contamination of groundwater is widespread due to on-lot sewage systems which were in place prior to state regulations. The soils are poorly suited for on-lot disposal. The completion of planned and under-construction treatment plants will greatly improve this overall condition. (Garrison-Omniplan)
W84-00840

STATE WATER PLAN: SUBBASIN 10, LOWER WEST BRANCH SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-11, December 1979. 132 p, 20 Fig, 42 Tab, 6 Append.

Descriptors: *River basins. *Stream pollution, *Agricultural runoff, *Septic tanks, *Septic wastewater, *Industrial waste, *Sediment yield, Fish populations, Groundwater pollution, Leachates, Erosion control, Electric power demand, Long-term planning, Recreation demand, *Pennsylvania, Lower West Branch Susquehanna River.

A series of 23 reports being published as a result of initial ivestigations and studies conducted in connection with the State Water Plan of Pennsylvania includes this area designated as Subbasin 10. Its northern half is in the Appalachian Plateau, and the southern half is in the mountainous Valley and Ridge Province. The overall basin is 66% forested with 22% in agriculture. Most of the water quality problems identified are associated with malfunctioning septic tanks and agricultural runoff. Future mining activities must be carefully controlled to prevent possible degradation. Industrial waste slugs from the Federal Penitentiary near Lewisburg have caused fish kills in Buffalo Creek. Groundwater pollution incidents have occurred as a result of landfill leachates or septic system malfunctions. The average sediment yield of 219,000 tons per year could be reduced through the use of better erosion control measures on privately owned lands. The largest single water user within the basin is the Montour electric power generating plant, which consumes approximately 12.6 mgd. Crop irrigation and public water supplies require significant amounts of water in the basin. There are 21 public water suppliers in the basin. Most of the streams are of good quality and provide good fishing, particularly Loyalsock, Lycoming and Muncy Creeks. (Garrison-Omniplan)
W84-00843

STATE WATER PLAN: SUBBASIN 9, CENTRAL WEST BRANCH SUSQUEHANNA RIVER.

Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-10, February 1980. 132 p, 20 Fig, 43 Tab, 6 Append.

Descriptors: *River basins, *Wilderness areas, *Wild rivers, *Water quality, *Stream pollution, *Acid mine drainage, *Groundwater pollution, *Flood damage, Flood control, Flood protection, Mountains, Iron, Manganese, Scenery, *Pennsylvania, West Central Branch Susquehanna River.

Subbasin 9 in Pennsylvania is roughly 85% wooded, and is set in very mountainous terrain with deep cut streams where the wilderness areas have been largely preserved. Large portions of the area are in state ownership. Subbasin 9 is described in one of 23 reports being published as a result of initial investigations and studies conducted in connection with the State Water Plan of the Commonwealth. The primary water quality problems arise from acid mine drainage and inadequately treated wastewater. Iron and manganese concentrations continue to be excessive downstream of Lock Haven and acid slugs, which reduce the pH to as low as 4.4, have occasionally occurred. There have been some instances of groundwater pollution, particularly in the limestone valleys in the lower portion of the basin. Each year, despite the small population of the area, the subbasin sustains an average of $3.7 million in damages from floods as a result of the large number of communities in the valleys. There are 35 public water suppliers of which eight do not have sufficient source capacity to meet their present needs in a drought. Also covered in the report are goals and objectives, and physical and socio-economic features. (Garrison-Omniplan)
W84-00844

STATE WATER PLAN: SUBBASIN 8, UPPER WEST BRANCH SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
For primary bibliographic entry see Field 5B.
W84-00845

STATE WATER PLAN: SUBBASIN 7, LOWER SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-8, February 1980. 267 p, 20 Fig, 44 Tab, 6 Append.

Descriptors: *River basins, *Flood control, *Water allocation, *Flood protection, *Municipal wastes, *Electric power demand, *Flood plain management, Recreation demand, Streams, Rivers, Groundwater pollution, Nonstructural alternatives, Project planning, *Pennsylvania, Lower Susquehanna River.

Subbasin 7 is a major agricultural area within Pennsylvania and has outstanding soils associated with the limestone valleys. This subbasin is described in one of 23 reports being published as a result of initial investigations and studies conducted in connection with the State Water Plan of the Commonwealth. Streams are used in this subbasin for water supply, waste water disposal, and for industrial and agricultural usages. Urban development has created many water resources problems. Flooding, which was a relatively minor problem in the past, has now become fairly frequent. It was found that very few additional projects could be economically justified, such as a flood control reservoir on Chickies Creek above Manheim or various local protection alternatives in Harrisburg. Fertilizers being used for agriculture and municipal waste discharges are causing algae to grow in many of the streams. Electric power needs are placing a heavy requirement on the Susquehanna River to cool the condensors of the electric generators. Many streams in the basin have outstanding aesthetic qualities and are suitable for fishing and boating. The quality of groundwater in Subbasin 7 is generally good to excellent except for certain limestone regions where nitrate and overall hardness problems exist. Groundwater incidents have occurred, especially from hydrocarbon pollution, which is a serious problem in the Mechanicsburg area. Other problems have been caused by landfill leachates, malfunctioning septic systems, fertilizers, and animal wastes. (Garrison-Omniplan)
W84-00846

STATE WATER PLAN: SUBBASIN 5, UPPER CENTRAL SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-6, December 1978. 168 p, 20 Fig, 40 Tab, 6 Append.

Descriptors: *Rivers, *Stream pollution, *Flood control, *State jurisdiction, *Acid mine drainage, *Coal mines, *Flood protection, Mountains, Municipal wastes, Project planning, Dam construction, Dams, Water quality standards, *Pennsylvania, Upper Central Susquehanna River.

All of Subbasin 5 is within the Appalachian Mountain Section of the Valley and Ridge Province. It includes the drainages of the Lackawanna River and the Susquehanna River from the mouth of the Lackawanna to the confluence with the West Branch Susquehanna. This report is one of 23 being published as a result of the initial investigations and studies conducted in connection with the State Water Plan of the Commonwealth of Pennsylvania. The report outlines goals and objectives, and physical features and climate of the subbasin. In addition, there are recommendations regarding flood damage reduction, water quality and supply, and outdoor recreation. Past coal mining activities have left many of the streams severely polluted with acid mine drainage. In addition, municipal wastes of degrading the streams. The most serious problem in the basin is the flooding caused by runoff from the steep mountainous terrain. With the protection provided by flood control projects now completed or under construction, the residual damages have been reduced to $5.2 million per year. Feasible and recommended dam projects include the proposed Soil Conservation Service dam, PA 665, on Nescopeck Creek in Watershed D; dam site 37-9; and channel modification projects for the communities of Moscow and Conyngham. Planned or completed acid mine drainage abatement projects are expected to improve 23 miles of the Lackawanna River. The most pressing water supply problem is within the Pennsylvania Gas and Water Company system, which services about 428,000 people. (Garrison-Omniplan)
W84-00848

STATE WATER PLAN: SUBBASIN 4, UPPER SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-5, June 1979. 146 p, 19 Fig, 41 Tab, 6 Append.

Descriptors: *River basins, *Stream pollution, *Acid mine drainage, *Industrial wastewater, *Dam construction, Project planning, Long-term planning, State jurisdiction, Flood control, Flood protection, Water pollution control, Scenery, Streams, Rivers, *Pennsylvania, Upper Susquehanna River.

Subbasin 4, which approximates the area known as the Northern Tier Region of Pennsylvania is described in one of 23 reports being published as a result of the initial investigations and studies conducted in connection with the State Water Plan of the Commonwealth of Pennsylvania. Farming had been the primary economic base of the area for many years, but it has been replaced by manufacturing. Fishing and hunting in the area is quite good. Most of the streams are of good quality, however, they tend to flood during storms and usually have low flows during droughts. It is recommended that the construction of both the Tioga-Hammond and Cowanesque Lake projects be completed as soon as possible. The potential Towanda Reservoir site should be studied further to evaluate its flood control, recreation, water supply, low flow augmentation and hydropower potential. The average annual damages in the basin would have been $5.8 million if existing projects had not been built. Eight streams in the basin have been identified as candidates for the Pennsylvania Scenic Rivers System. The Susquehanna River generally has good water quality, but gives evidence of excess iron concentrations from acid mine drainage upstream, as well as domestic and industrial wastewater and sedimentation problems. Organic pollution, sedimentation and acid mine drainage are the main problems on the Tioga River. Water use in the basin is relatively small, at 423 mgd, with projections of 66 mgd by 1990. (Garrison-Omniplan)
W84-00849

STATE WATER PLAN: SUBBASIN 1, UPPER DELAWARE RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-2, January 1983. 157 p, 20 Fig, 42 Tab, 6 Append.

Descriptors: *Stream pollution, *Flood control, *State jurisdiction, *Rivers, *Water demand, *Flood protection, *Long-term planning, Scenery, Recreation demand, Groundwater pollution, Water quality management, Water policy, *Pennsylvania, Upper Delaware River.

This is one of 23 reports being published as a result of the initial investigations and studies conducted in connection with the State Water Plan of the Commonwealth of Pennsylvania. Subbasin 1 includes all of the direct drainage into the Delaware River in northeast Pennsylvania above the Lehigh River. The fact that this area remains relatively undeveloped has made it an ideal area for recreational development; however, the area is flood prone. All of the damage centers in Subbasin 1 have had their floodplains mapped and all but one are eligible for Federal flood insurance. Within Subbasin 1, 16 stream reaches have been selected as candidates for inclusion in the State Scenic Rivers System. The total water use within Subbasin 1 is currently 547 mgd, of which 511 mgd is used by the Portland and Martins Creek electric generating plants. There are 35 public water suppliers in Subbasin 1. Five of these suppliers also serve water in Subbasin 2, which results in 4 mgd being diverted out of the subbasin. Sedimentation and erosion problems in this basin are relatively small. The quality of surface and groundwater in the subbasin is good to excellent, but there are ten areas where there are significant sources of pollution. Groundwater pollution incidents have occurred primarily as a result of landfill leachate seepage and malfunctioning on-lot disposal systems. The report lists goals and objectives, water resources problems and solution alternatives, as well as physical features and climate of the subbasin. (Garrison-Omniplan)
W84-00850

LONG RANGE PLANS FOR HYDROLOGIC INVESTIGATIONS,
Geological Survey, Albuquerque, NM. Water Resources Div.
H. L. Case, and G. E. Welder.
Proceedings of Twenty-eighth Annual New Mexico Conference, 'Water Quality in New Mexico,' April 5-6, 1983. WRRI Report No 169, New Mexico Water Resources Research Institute, Las Cruces, June 1983. p 78-109, 9 Fig, 1 Tab, 2 Ref.

Descriptors: *Data collection, *Surveys, *Hydrologic data, *Long-term planning, *Project planning, *Water quality, *Groundwater, *Areal hydrogeology, *Surface-groundwater relations, Coal mines, Public policy, Water resources institutes, *New Mexico.

The need for water resources information in New Mexico is constantly changing as the availability, use, and management of water changes. Objectives of the eight Hydrologic data collection projects presented include continuing to identify future data needs; conducting an analysis of the water quality, ground and surface water observation networks; and entering all available current and historical hydrologic data into the U.S. Geological Survey Data Survey and Retrieval System (WATSTORE). Objectives of areal appraisal studies include evaluating the water resources in the Gallup-

Grants-Zuni-Acoma sag area and on the western flank of the Sandia and Manzano mountains in Bernalillo County. Potential projects for basin assessments include quantifying the ground water/surface water relationships on rivers with flow governed by compacts, and an investigation of the water resources of the Estancia basin. Projects that will assist in the evaluation of energy-related activities include describing the effects of resaturation of coal mines and of milling operations on the quality and quantity of ground and waters. Activities that need to be undertaken to deal with waste disposal problems include the evaluation of the hydrologic factors at the Albuquerque South Valley 'superfund' site and the establishment of a monitoring network at the Waste Isolation Pilot Plant near Carlsbad. (Garrison-Omniplan)
W84-00852

HARBOR MANAGEMENT STRATEGIES FOR NEW ENGLAND,
New England River Basins Commission, Boston, MA.
S. L. Richmond.
Report, September 1981. 48 p, 3 Fig.

Descriptors: *Harbors, *Management planning, *Long-range planning, *Interagency cooperation, *Water policy, *Public policy, *Public access, Comprehensive planning, Nonstructural alternatives, Multiobjective planning, Projections, Coastal zone management, Area redevelopment, *New England, Northeast U.S.

New England harbors possess numerous physical constraints to development. The most significant of these are a limited land and water base, the high cost of capital improvements to existing infrastructures, the predominance of private ownership, and the presence of many non-water dependent long-term uses. In addition, New England's harbor communities are limited in their abilities to successfully resolve harbor use conflicts because of fragmented harbor planning, management, and regulations; lack of a common goal shared by local harbor interests; and lack of legal agreement on the nature of the public's interest in harbor resources. Unlike West Coast states, New England states lack a strong legal tradition of fully protecting the public's interest in harbor resources. New England harbor communities should establish local harbor management structures that include both an institution with equitable representation from all relevant jurisdictions and public and private interest groups; and a plan that allocates limited harbor shoreline and harbor waters among competing users. Such a structure could range from an informal networking of existing agencies and interest groups with a common set of goals, to a formalized harbor government with broad planning, management, financing, and regulatory authorities. (Garrison-Omniplan)
W84-00907

PROSPECTS AND STRATEGIES FOR NEW ENGLAND PORTS.
New England River Basins Commission, Boston, MA.
Report, September 1981. 68 p, 13 Fig, 7 Tab.

Descriptors: *Port facilities, *Regional planning, *Management planning, *Waterfront facilities, *Port authorities, *Long-range planning, Multiobjective planning, Profit, Property rights, Harbors, Economic evaluation, Economic yield, *New England, Northeast U.S.

Throughout the decade of the 1970s, New England continued to rely heavily on waterborne trade: over 80 million tons of cargo annually passed through the region's 10 major commercial ports. Approximately 92% of this waterborne commerce consisted of petroleum and petroleum products. The direction of trade flows was predominantly inbound, as receipts comprised over 90% of total 1977 tonnage. Approximately 20% of the total volume of regional waterborne trade has been handled through common-user marine terminals. The volumes of cargo shipped through New England's common-user facilities have remained relatively stable over the past 15 years and are not projected to grow as rapidly as is trade throughout the South and West. New England's 10 major common-user ports are administered by a variety of port organizations. The region is characterized by one port: the Massachusetts Port Authority, which is substantially more sophisticated in operations than its neighboring ports. Additionally, the New England region is unique in containing four privately-owned common-user facilities. With few exceptions, New England port organizations have minimal marketing and planning capabilities. The majority of New England port facilities have emphasized the capability to handle a variety of neo-bulk (lumber, steel) and bulk (salt, scrap metal) cargoes. While some common-user facilities operate at near capacity, an equal number of facilities operate with excess cargo-handling capacity. (Garrison-Omniplan)
W84-00908

REPORT ON REVIEW OF WATER SUPPLY PLANNING, RECOMMENDATIONS AND STRATEGY FOR WESTERN CONNECTICUT.
Anderson-Nichols and Co., Inc., Newington, CT.
Report prepared for the Western Connecticut Water Supply Council, July 1983. 66 p, 4 Append.

Descriptors: *Water yield, *Safe yield, *Water deficit, *Pipelines, *Potential water supply, *Interagency cooperation, Water supply development, Potential water supply, Yield, Water scarcity, Government interrelations, Water policy, Public policy, Longrange planning, *Connecticut.

The goals of this study were to review the water supply plan for Western Connecticut and to assess available water supply alternatives, institutional issues, small water company issues and data adequacy. A review of safe yields for the existing water supplies in Western Connecticut revealed a continuing inconsistency and inaccuracy of reported safe yields. The utilities project a year 2000 deficit of 5.2 mgd for southern Fairfield County alone, while the Corps of Engineers projects a total deficit of 5.0 mgd for 5 of 13 communities in the entire region for this year. Both the short-term and long-term water supply plans evaluated in the Housatonic River Basin Urban Study on a local and regional basis have legal, financial, institutional, or environmental barriers to implementation. The issues of water policy, legal and legislative needs as well as the issue of Class 'B' waters must be resolved first, in order to properly and thoroughly evaluate water supply plans. Several interconnections are viable alternatives, including a major interconnection between Bridgeport Hydraulic and adjoining communities in southern Fairfield County. This pipeline offers a viable solution to the water supply problems of the area. An analysis was conducted of regional water authorities, and a statewide water supply master plan is suggested. Regarding take-overs of small water companies, greater reliance should be placed on providing financial incentives rather than using state action. (Garrison-Omniplan)
W84-00911

NONPOINT SOURCES,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
M. G. Wolman, and C. E. Chamberlin.
In: Proceedings of the National Water Conference, Water Quality and The Clean Water Act, Philadelphia, Janary 26 and 27, 1982. Academy of Natural Sciences, Philadelphia, July 1982. p 87-100, 16 Ref.

Descriptors: *Nonpoint pollution sources, *Pollution load, *Water pollution sources, *Water pollution effects, *Chemical wastes, *Pesticide toxicity, Water quality, Water quality data, Cost-benefit analysis, Public policy, Water policy, Water quality standards.

Pollutant discharges from both point and nonpoint sources affect the quality of rivers, lakes, estuaries, and ocean shorelines. In 1976 it was reported that after projected reductions of a variety of pollutants such as ultimate BOD, nitrogen, phosphorus, coliforms and several metals, in accord with requirements for BPT and secondary treatment by 1977, substantial loadings would remain for such pollutants as total nitrogen, phosphorus, and fecal coliforms. It was estimated that even after elimination of discharge, 79% of nitrogen, 53% of total phosphorous, 99% of coliforms, but only 11% of oil and grease would remain. The diversity of human activities and natural background across the country results in markedly different sources and characteristics of pollutants, with the result that uniform approaches will not achieve desired objectives. In general, it has been found that the organic content expressed as BOD and COD of runoff and discharges are generally comparable to concentrations found in effluents from secondary sewage treatment plants. Unit yields of sediment from construction sites may exceed previous background values 10 to 50-fold with concentrations on the order of 10,000 mg/1. For planning purposes, models are needed to compare the relative values of expenditures for control of diverse sources of pollutants to achieve given uses. (Garrison-Omniplan)
W84-00916

THE ECONOMIC VALUE OF GROUND WATER RECHARGE FOR IRRIGATION USE,
Nebraska Univ.-Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4B.
W84-00957

6D. Water Demand

DETERMINATION OF IRRIGATION PUMPAGE IN PARTS OF KEARNY AND FINNEY COUNTIES, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
R. J. Lindgren.
USGS Water-Resources Investigations 82-4011, 1982. 26 p, 141 Fig, 2 Tab, 6 Ref.

Descriptors: *Irrigation requirements, *Pumpage, *Soil moisture, Wilting point, Field capacity, Water demand, Evapotranspiration, Consumptive use, Kearny County, Finney County, *Kansas.

Irrigation pumpage was determined for parts of Kearny and Finney Counties in Southwestern Kansas using crop-acreage data and consumptive, irrigation-water requirements. Irrigated acreages for 1974-80 were compiled for wheat, grain sorghum, corn, and alfalfa using records from the U.S. Agricultural Stabilization and Conservation Service. Consumptive-irrigation requirements were computed using a soil-moisture model. The model tabulated monthly soil-moisture and crop-water demand for various crops and computed the volume of irrigation water needed to maintain the available moisture at 50% for loamy soils or at 60% for sandy soils. Irrigated acres in the study area increased from 265,000 acres during 1974 to 321,000 acres during 1980. Irrigation pumpage increased from 584,000 acre-feet during 1974 to 738,000 acre-feet during 1980. Decreased consumptive-irrigation requirements during 1979 resulted in a comparatively small irrigation-pumpage estimate of 458,000 acre-feet. (USGS)
W84-00772

THE STATE WATER PLAN, SUBBASIN 17, CENTRAL ALLEGHENY RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-17, December 1980. 146 p, 21 Fig, 48 Tab, 6 Append.

Descriptors: *Groundwater movement, *Groundwater potential, Groundwater availability, *Aquifer characteristics, *Acid mine drainage, *Strip mine wastes, *Surface water, Groundwater level, Aquifers, Mine wastes, Fuel, Industrial wastes, Coal mine wastes, Gasoline, Oil pollution, *Pennsylvania, Allegheny River.

The rugged terrain of the Appalachian Plateaus Province characterizes Subbasin 17 in Pennsylvania, where roughly two-thirds of the land is forested and one-sixth is in agriculture. The area's economy is largely based on its minerals. Coal, gas and

oil have been mined heavily in the past; coal is the major mineral resource being mined today. Abandoned coal mines, both deep and strip, as well as abandoned oil wells and gas wells are responsible for the degradation of many streams by acidity and iron. The scenic streams in the rugged terrain are valuable resources that have been despoiled by pollution. The quality of fishing in most of the streams is generally low. While the surface waters in the basin are largely polluted by acid mine drainage, the groundwaters are generally good. The exception occurs in the Claron County area where previous mining activities and inter-connected abandoned gas wells have caused widespread groundwater pollution. Water quality problems of Subbasin 17 are being examined and water quality standards and wastewater treatment plans are being developed. The heaviest water use in the subbasin occurs in the southern portion, which has two existing electric power stations, and 77 mgd of self-supplied industrial water use. These uses alone account for 312 mgd out of a total of 368 within the basin. Consumptive water use in the subbasin currently is 30 mgd and is projected to increase to 64 in 1990. It is recommended that low head hydropower studies be conducted in this subbasin. There are 56 public water suppliers in the basin, of which 48 have developed their own sources of supply. (Garrison-Omniplan)
W84-00784

THE STATE WATER PLAN, SUBBASIN 19, MONONGAHELA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-19, July 1982. 175 p, 21 Fig, 48 Tab, 6 Append.

Descriptors: *Stream pollution, *Stream improvement, *Rivers, *Coal mine wastes, *Waste pollution control, *Water quality control, *Water pollution sources, Steel industry, Industrial wastes, Acid mine drainage, Sewers, Surface water, *Pennsylvania, Monogahela River.

The abundance of coal and associated mining activities have created a serious water quality problem in the Monongahela River in Pennsylvania. It has also indirectly led to a water supply problem in the basin because of the concentration of steel and related industries, as well as power generation facilities whose daily water use totals over three billion gallons. The overall problems of the subbasin point to the particularly serious need for the construction of the Rowlesburg Reservoir on the Cheat River in West Virginia. Many alternatives have been explored but this is the only project which offers a viable solution to all of the problems which exist on this river. Although mine acids have been significantly reduced, concentrations of total dissolved solids and sulfates during low flow periods occasionally exceed the acceptable standards of 500 mg/l and 250 mg/l in the river by more than 75%. An examination of the tremendous costs involved in treating these pollutants points to the only feasible economic solution: streamflow augmentation. By releasing water for storage during low flows, pollutants would be diluted to acceptable standards. Other water quality problems which have been identified in this area include urban stream drainage, including combined sewer flows; various of nonpoint sources; thermal pollution; landfill leachate; and excessive mineral constituent concentrations in surface and groundwaters. The most critical water supply problem is the conflict between the water supply uses of the river during low flow periods and the use of the river for commercial navigation. (Garrison-Omniplan)
W84-00785

MORRIS COUNTY MASTER PLAN: WATER SUPPLY ELEMENT.
Killman (Elston T.) Associates, Inc., Millburn, NJ.
Report submitted to the Morris County Planning Board, N.J., October 1982. 94 p, 7 Tab, 16 Ref, 4 Append, 4 Plates.

Descriptors: *Long-term planning, *Water supply, *Water demand, *Water supply development, *Alternative planning, Administrative regulations, Water costs, Areal hydrogeology, Groundwater, Water quality, Groundwater pollution, Wells, Chemical analyses, Regional planning, Aquifers, *New Jersey, Morris County.

The recent drought and water supply shortage which affected northern New Jersey has illustrated the need for ample water supply reserves and long range planning. The study examines these issues and presents recommendations which would improve the quality and reliability of water supply services in Morris County. Water supplies are ample and are derived from both surface and groundwater sources, with groundwater accounting for the greatest percentage of water consumed. This report highlights the County's dependence on its subsurface aquifers, locates them, and forms a starting point from which local municipalities can take steps to further protect their drinking water supplies. The study analyzes water supply sources, facilities, consumption patterns, and future needs. Extensive development and diversion of surface water out of the County has reduced available supplies. In recent years, episodes of groundwater contamination have jeopardized or closed several municipal supplies. Responsibility for management and distribution of potable water in Morris County is vested in numerous independent water companies, both public and private. Thus, implementation of long-term water supply management strategies can be difficult. This report defines the role of the Morris County Municipal Utilities Authority in overcoming that problem. (Fazio-Omniplan)
W84-00788

THE BENCHMARK FARM PROGRAM-- A METHOD FOR ESTIMATING IRRIGATION WATER USE IN SOUTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00808

SUBBASIN 13, POTOMAC RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-14, June 1979. 98 p, 18 Fig, 39 Tab, 6 Append.

Descriptors: *Industrial wastes, *Rivers, *Stream pollution, *Reservoirs, *Interstate rivers, *Water quality standards, *Irrigation requirements, Recreation, Water conservation, Conservation, Legal aspects, State jurisdiction, Wild rivers, *Pennsylvania, Potomac River basin.

Water use in Subbasin 13 in Pennsylvania is relatively light; the greatest increase in usage is expected to be for crop irrigation. Current usgage is 23.1 mgd and is projected to grow to only 49 mgd in 1990. Public water supply is the largest use in the basin, amounting to 7.8 mgd. There are 24 public water suppliers of which all but seven serve fewer than 1,000 customers. Most of the suppliers get their water from wells or springs. It is strongly recommended that applicable conservation measures be applied by all suppliers whose residential gpcd exceeds 50 or whose industrial usage appears excessive. The Potomac River Basin is besieged with interstate water issues because the metropolitan Washington, D.C. area is short of water and badly needs reservoir development upstream. One project, Sixes Bridge Reservoir on the Monocacy River in Maryland, would back water just across the Pennsylvania border into Adams County. Because of the projected irrigation demands in Pennsylvania, there is a potential conflict between Pennsylvania's right to the water flowing into the reservoir and the water supply interests downstream. Flooding in this basin is a minor problem. There are many opportunities for water-related outdoor recreation in Subbasin 13. In the future, additional picnic tables, swimming pools and flatwater for power boating will be needed. Three streams have been selected as candidates for the State's Scenic Rivers System. There are a few local groundwater quality problems from nutrient enrichment by agricultural runoff, improperly treated sewage, malfunctioning on-lot disposal systems and industrial waste discharges. (Garrison-Omniplan)
W84-00841

SUBBASIN 12, LOWER JUNIATA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-13, June 1979. 104 p, 19 Fig, 40 Tab, 6 Append.

Descriptors: *Flood frequency, *Irrigation requirements, *Sediment yield, *Soil erosion, *Surface water, *Rivers, Leachates, Conservation, Industrial wastes, Raw wastewater, Treatment facilities Silt, Water supply, *Pennsylvania, Upper Junita River.

About two-thirds of Subbasin 12 in Pennsylvania is forested, and one-quarter is farmland. This valley has become a center for the Amish sect, a religious group well known for their farming abilities. The urban centers in the basin are located primarily along the Juniata River. Flood damage is common occurrence in this basin because of the mountainous terrain surrounding the communities along the river. There are 20 damage centers and 22 damage reaches identified which have existing flood problems. There are 21 public water suppliers in the basin, of which 20 have their own sources of supply. The total water use in the basin in 1970 was 48 mgd, of which nearly 38 mgd was for self-supplied industry. If agricultural crop irrigation grows as projected, this may be one of the largest water uses in the future. Streamflows will be diminished if surface streams are used as the water source. There have been a few reported incidents of groundwater pollution from seepage of landfill leachates and malfunctioning septic systems. Erosion in the basin is a problem because of the extensive farming of agricultural land, which accounts for the slightly above-average sediment yield of 86 tons/sq. mile from the basin. It is recommended that agricultural conservation plans be implemented to reduce this problem. Inadequately treated industrial wastes, raw domestic wastewater and siltation are problems in Kishacoquillas Creek; however, the planned construction of Brown and Armagh Townships' treatment facilities should alleviate these wastewater problems. Subbasin 12 is ideally suited for many water-related outdoor recreational pursuits. (Garrison-Omniplan)
W84-00842

STATE WATER PLAN: SUBBASIN 6, LOWER CENTRAL SUSQUEHANNA RIVER.
Pennsylvania Dept. of Environmental Resources, Harrisburg. Office of Resources Management.
Report SWP-7, January 1980. 138 p, 20 Fig, 41 Tab, 6 Append.

Descriptors: *River basins, *Flood control, *Flood protection, *Electric power demand, *Dam construction, *Project planning, *Agriculture, *Long-term planning, Coliforms, Water quality standards, Recreation demand, Nonpoint pollution sources, *Pennsylvania, Lower Central Susquehanna River.

The Susquehanna River is a vital artery in the development of Subbasin 6, which lies entirely within the Valley and Ridge portion of Pennsylvania. This subbasin is described in one of 23 reports being published as a result of initial investigations and studies conducted in connection with the State Water Plan of the Commonwealth. The river supplies water for manufacturing and cooling of condensors for electric power generation, in addition to recreation opportunities. Very intense farming, which results in the area being the second leading crop producer in Pennsylvania, will mean increasing demands on the water resources for irrigation and will also increase nonpoint pollution to the streams. This area has also experienced intense flooding. To further reduce problems in the Middle Creek watershed, it is recommended that dams PA-636 and PA-638, floodway PA-639, and dike PA-640, be constructed as soon as possible. In the less populated areas, water quality is generally good except where polluted tributaries feed into it, such as at the mouths of Shamokin and Mahanoy Creeks. Also, there have been some algae blooms and high coliform concentrations in the Sunbury area. The report lists goals and objectives, and physical features and climate of the subbasin. (Garrison-Omniplan)
W84-00847

WATER, WATTS, AND WILDS: HYDROPOWER AND COMPETING USES IN NEW ENGLAND.
New England River Basins Commission, Boston, MA.
Final Report of the New England River Basins Commission's Hydropower Expansion Study, August 1981. 136 p, 14 Fig, 25 Tab, 5 Append.

Descriptors: *Dams, *Hydroelectric power, *Electric power costs, *Hydroelectric plants, *Electric power production, *Electrical equipment, Dam effects, Environmental effects, Regional planning, Electric power, Electric potential, Economic aspects, *New England, Northeast U.S.

NERBC has identified 320 existing or breached dam sites in New England which could be retrofitted to generate hydroelectricity at an estimated cost of 125 mills ($.125) per kilowatt hour or less. These sites are the most economically attractive sites screened from an inventory of over 10,000 dams throughout the six-state region. The total generating capacity which could be developed at these 320 sites ranges from 300 to 600 megawatts. NERBC also identified 44 sites where no dams currently exist and where power could be generated for an estimated cost of 115 mills per kilowatt hour or less. The total generating capacity which could be developed at these 44 sites ranges from 270 to 475 megawatts. Hydropower currently contributes between 4% to 6% of the electricity generated annually in the region. If all of the 320 existing and breached dams that ranked most favorably in the NERBC analysis were retrofitted with power plants, they could generate about 2 million megawatt hours, providing an additional oil savings of 3.5 million barrels, or about 4.5% of current consumption. Some competing uses are likely to cause conflict, although not every impact of hydro development is necessarily negative. However, opposition to the construction of new dams at previously undeveloped sites is likely to be substantial. (Garrison-Omniplan)
W84-00914

WATER USE IN WISCONSIN, 1979,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W84-00928

HISTORIC AND PREHISTORIC PATTERNS OF WATER USE IN THE CONNECTICUT RIVER VALLEY: IMPLICATIONS FOR WATER RESOURCES PLANNING,
University of Northern Iowa, Cedar Falls. Dept. of Socialogy, Anthropology and Social Work.
J. R. Cole, and M. T. Mulholland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140615, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Center Publication No 143, Massachusetts Univ., Amherst, June 1983. 144 p, 13 Fig, 12 Tab, 106 Ref, 2 Append. OWRT A-130-MASS, 14-34-0001-1123.

Descriptors: *Archaeology, *Climatic data, Climatology, Data acquisition, *Forecasting, *Historic floods, *Hydrologic data collections, Meteorological data collection, *Planning, Climates, Drought, Flood data, Flood forecasting, Forest Watersheds, Humid climates, Prediction, Weather forecasting, *Connecticut River basin.

Water supply forecasting typically is based upon instrumented records from the recent past ranging from recent year-of-record data to 30-year 'normals', and, rarely (because of the lack of records), 100-year extremes. This report examines 144 years of instrumented records at Amherst, Massachusetts, 400 years of proxy records from tree rings, diaries, newspapers, and other historical records, and the records of thousands of years of archeaological data in order to evaluate the extent to which historic and prehistoric climatic cycles might provide models for the future. The authors suggest that although long-term past data are poorly documented, historians should make more use of data which can be reasonably verified. The authors found no clear statistical patterns or cyclicity in climatological records for the Amherst area. Neither do instrumented data support Nineteenth Century newspaper and diary accounts or archaeological reports. Nevertheless, climatologists, archaeologists, and historians seem to overrate climatological factors while, at the same time, downgrading historical data beyond the recent past and failing to employ tests of statistical significance. The humid Northeast would seem to have broader stress tolerances than assumed by some environmental activists, but greater limits than assumed by many developers and planning activists.
W84-00968

LEGAL ASPECTS OF STORED WATER IN FEDERAL RESERVOIRS IN KANSAS,
Kansas State Univ., Manhattan. School of Law.
For primary bibliographic entry see Field 6E.
W84-00971

OCCURRENCE AND USE OF GROUND WATER IN THE VENICE-ENGLEWOOD AREA, SARASOTA AND CHARLOTTE COUNTIES, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. Sutcliffe, Jr., and T. H. Thompson.
USGS Open-File Report 82-700, 1983. 59 p, 21 Fig, 8 Tab, 14 Ref.

Descriptors: *Groundwater availability, *Groundwater quality, Aquifers, Water use, *Florida, Floridan aquifer.

In a 75-square-mile area of coastal Sarasota and Charlotte Counties, demand for water is increasing. Groundwater, the principal source of supply, is distributed largely by public water systems. Principal water-bearing formations in descending order, include the surficial aquifer, artesian zone 1 in the Tamiami Formation, zone 2 in the upper part of the Hawthorn Formation, zone 3 in the lower part of the Hawthorn Formation and upper part of the Tampa Limestone, and zones 4 and 5 which comprise the Floridan aquifer. The surficial aquifer, except near tidewater, provides limited supplies of freshwater to wells. Artesian zone 1 is the major aquifer for public supply. It is contaminated by saline water in some areas, either as a result of inundation by storm-driven tides or by upwar leakage of mineralized water from underlying aquifers through uncased or improperly constructed wells. The city of Venice obtains some water from zone 2, but the water is brackish in much of the area. The water is suitable for irrigation in parts of the area. Except for local use of water for watering livestock and maintaining ponds, the water from zones 3, 4, and 5 is little used because of its poor quality. (USGS)
W84-00987

PUMPAGE OF WATER IN LOUISIANA, 1980,
Geological Survey, Baton Rouge, LA. Water Resources Div.
W. H. Walter.
Louisiana Department of Transportation and Development, Baton Rouge, Water Resources Special Report No 3, 1982. 15 p, 3 Fig, 3 Tab, 25 Ref.

Descriptors: *Water utilization, *Louisiana, Withdrawal, Groundwater, Surface waters, Saline water, Consumptive use, Aquifers, Water supply, *Water use, *Pumpage, *Water-use trends, Domestic use, Public-supply use, Rural use, Irrigation use, Industrial use, Thermoelectric use, Livestock use, Per-capita use.

In 1980 an estimated 12,500 million gallons per day of water was pumped for various uses in Louisiana; 10,700 million gallons per day was pumped from surface-water sources and 1,780 from ground water. Two-thirds of the surface-water withdrawals were from the Mississippi River, mainly for industrial use; and about 56% of the ground water was pumped from the Chicot aquifer in southwestern Louisiana, mainly for irrigation. Total withdrawal use of water in the State increase by 6%, 1975-80. Use of surface water increased by 5% while use of ground water increased by 14%. (USGS)
W84-00997

6E. Water Law and Institutions

HARBOR MANAGEMENT STRATEGIES FOR NEW ENGLAND,
New England River Basins Commission, Boston, MA.
For primary bibliographic entry see Field 6B.
W84-00907

INDUSTRIAL WASTEWATER,
Texas Univ. at Austin. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5G.
W84-00917

INTERSTATE WATER LAW ISSUES: UNILATERAL STATE LEGISLATION, ORIGINAL SUITS IN THE SUPREME COURT, INTERSTATE COMPACTS,
North Carolina Univ. at Chapel Hill. Inst. of Government.
M. S. Heath, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140532, Price codes: A04 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute Completion Report, September, 1983. 48 p, 85 End notes. OWRT A-121-NC(b)(2), 14-34-0001-2135.

Descriptors: *Water law, *Interstate compacts, *Legal aspects, Legislation, *Judicial decisions, Water importing, State jurisdiction, Proprietary power, Constitutional law, Groundwater, Surface water, Equitable apportionment, Riparian rights.

The principal legal avenues for resolving interstate water disputes involve either legislation, litigation or interstate cooperation. This report addresses one option in each of these categories that may be available to state governments: unilateral state legislation designed to restrict outsiders from access to a state's water resources; original actions against a neighboring state in the U.S. Supreme Court; and interstate compacts. The opportunities for unilateral state legislation have been severely restricted by recent Supreme Court decisions, though several developing areas of constitutional law should be monitored closely for their possible future impact on this subject. Original actions in the Supreme Court may offer the possibility that the court will place some limitations on withdrawal of interstate waters by a state, and this possibility may provide some leverage for another state that wants to contest this withdrawal, but original actions are beset by a number of obstacles and uncertainties. The interstate compact has long been regarded as a preferred enforceable alternative for resolving a water resources dispute - if you can get it.
W84-00960

PROBLEMS AND ISSUES RELATED TO MANAGING WATER SUPPLY AND WATER QUALITY BETWEEN NORTH CAROLINA AND VIRGINIA,
North Carolina State Univ. at Raleigh. Dept. of Political Science and Public Administration.
T. D. Edgmon, and R. Tarver.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140540, Price codes: A03 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute Completion Report, September, 1983. 48 p, 49 End notes. OWRT A-121-NC(a)(1), 14-34-0001-2135.

Descriptors: *Institutional constraints, *Legal aspects, *Political aspects, *Water supply, Water quality, *Interstate commissions, Water supply development, *Water quality management, Political constraints, Policy making, Legislation, Water laws, Administrative decisions, State jurisdiction, Water allocation, Interbasin transfers, Riparian rights, Interstate compacts, Eutrophication, Surface water, Groundwater.

The purpose of this report was to outline the problems, alternative solutions, and institutional arrangements associated with interstate issues of

managing water supply and water quality between North Carolina and Virginia. In this process, a political analysis was conducted, which indicated that because of inequalities in the distribution of costs and benefits associated with water resource use between parties on different sides of the state line, officials of the respective states do not share a common set of interests or political agenda. This conflict of interest could lead to either a benign neglect of water resource problems of the area, court actions, or the development of an institutional framework for the settlement of differences between interested parties and the management of water resources on an interstate, regional basis. The greatest impediment to the evolution of an interstate institution is the lack of state legislation upon which such an entity could be based. Given the legal status quo, the only positive steps that can be taken in the short run in the absence of legislation are executive and administrative actions, which over the long run, may be unstable and subject to change.
W84-00961

LEGAL ASPECTS OF STORED WATER IN FEDERAL RESERVOIRS IN KANSAS,
Kansas State Univ., Manhattan. School of Law.
J. C. Peck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-140649, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute Contribution No 241, August 1983. 85 p, 6 Fig. OWRT A-105-KAN(1), 14-34-0001-2118.

Descriptors: *Water rights, *Storage right, *Reservoir right, *Reservoir storage right, *Drought, *Federal nonreserved rights, Appropriation, Storage, Reservation right, Safe yield, Low-flow frequency curve, Condemnation, Federal reserved rights, Water quality.

Water is stored to protect against natural fluctuations. Kansas statutes are unclear relative to existence of such rights other than that obtainable by the Kansas Water Office. But the Division of Water Resources (DWR) has long recognized storage rights. Detailed procedures exist for obtaining the water reservation right from the Chief Engineer of the DWR by the Kansas Water Office. Federal law requires state assurance for payment for space used for municipal and industrial water storage. The reservation right has some similarities with an appropriation right, including a listing of priority dates and specification of quantity limitation. Once obtained, the reservation right is subject only to federal government condemnation. Concern has risen about protecting water quality releases made by the Corps of Engineers. This concern remains unsolved. Several possible solutions, including one in the Water Plan Storage Act, do exist, however. The Federal Government has a water right for storage designated for various authorized purpose. But the law is unclear, particularly in Corps of Engineers reservoirs, as to the exact nature of such right. It could arguably be a federal reserved right or another species of rights denominated as a federal non reserved right.
W84-00971

6G. Ecologic Impact Of Water Development

PROCEDURES FOR ASSESSMENT OF CUMULATIVE IMPACTS OF COAL MINING ON THE HYDROLOGIC BALANCE,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W84-00780

APPRAISAL OF THE INTERCONNECTION BETWEEN THE ST. JOHNS RIVER AND THE SURFICIAL AQUIFER, EAST CENTRAL DUVAL COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. M. Spechler, and R. B. Stone, Jr.
USGS Water-Resources Investigations Report 82-4109, 1983. 34 p, 14 Fig, 3 Tab, 33 Ref.

Descriptors: *Surface-groundwater relationship, *Saline water intrusion, Hydrogeology, Aquifers, Water quality, Channel improvements, St. John River, *Surficial aquifer, Limestone unit, *Florida, Duval County.

The proposed deepening of the navigation channel in the St. Johns River to about 46-48 feet below sea level (45 feet below mean low water) may breach up to 11 feet of limestone unit of the lower part of the surficial aquifer along a 25-mile channel. The limestone supplies water to numerous domestic wells along the river in the Jacksonville area. Recent channel improvements to about 39 feet below sea level have already breached the limestone at many locations. Where breaching has not yet occurred, less than 1 to 6 feet of undifferentiated sediments overlie the limestone. These sediments, consisting predominantly of sand, are generally too permeable to form an effective confining layer. Chloride concentrations determined from water in wells tapping the limestone unit range from 8 to 6,600 milligrams per liter. However, chloride concentrations in water from wells located more than 500 feet from the river, were generally less than 30 milligrams per liter. The proposed dredging operation is not expected to alter significantly the present hydrologic system. The current position of the interface most likely represents conditions that will be present after future channel improvements. (USGS)
W84-00975

RESERVOIR-DEVELOPMENT IMPACTS ON SURFACE-WATER QUANTITY AND QUALITY IN THE YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 4C.
W84-01042

7. RESOURCES DATA

7A. Network Design

EVALUATION OF THE STREAM-FLOW DATA IN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
H. N. Flippo, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-202002, Price codes: A04 in paper copy, A01 in microfiche. USGS Water Resources Investigations 82-21, December 1982. 56 p, 7 Fig, 8 Tab, 14 Ref.

Descriptors: *Network analysis, *Data collection, *Pennsylvania, Network design, Regional analysis, Gaging stations, Hydrologic data.

The potential for improvement of currently adopted data-transfer mechanisms, which consist of a series of regression equations that relate low-, mean-, and flood-flow characterististics, is evaluated by the technique known as Network Analysis for Regional Information (NARI). This evaluation showed that little improvement in the data-transfer mechanisms can be expected as a result of continued operation of various combinations of gages for as long as 25 years. Therefore, it is proposed that all current gages that are neither managerial nor design specific in purpose (are proposed to be) be discontinued when records adequate for definition of flow characteristics at the gaging site have been collected. Types of data collected, their most commonly used summarizations, and known usage of site-specific data are tabulated. This report cites 14 references. (USGS)
W84-00809

QUALITY ASSURANCE PRACTICES FOR THE CHEMICAL AND PHYSICAL ANALYSES OF WATER AND FLUVIAL SEDIMENTS,
Geological Survey, Lakewood, CO.
For primary bibliographic entry see Field 5A.
W84-00812

PROCEEDINGS: ILLINOIS WATER-DATA USERS MEETING, PEORIA, ILLINOIS, FEBRUARY 23-24, 1982.
Geological Survey, Urbana, IL. Water Resources Div.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $12.00 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-1001, December, 1982. 90 p, 10 Fig, L. G. Toler, compiler.

Descriptors: *Water measurement, *Water management, Hydrologic data collection, *Illinois, Water agencies, Data acquisition, Data users.

The increased demand for water and concern for the quality of water resources of Illinois have led to increased demand for water-resources data. Representatives of the major water-data collecting and water-data using agencies met in Peoria, Illinois, on February 23-24, 1982, to (1) exchange information on current water-data programs and needs; (2) identify areas where data are needed; and (3) foster coordination and cooperation among agencies. Recommendations of the group included (1) annual meetings of agencies for coordination of activities; (2) standard methods for collecting and analyzing water data be adopted; (3) a centralized data system be established as a means of sharing water data; (4) water data should be indexed and cataloged, either by each agency or by some centralized system; (5) a statewide water data coordination committee should be formed with members from all water-related agencies; (6) a work group be formed to consider the use of uniform water-data collection agencies in the State to coordinate and maximize efforts on basin intensive study projects. (USGS)
W84-00818

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
E. F. LeRoux, and E. M. Decker.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $6.50 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-912, July 1980. 47 p, 3 Tab.

Descriptors: *Hydrologic data, Water resources, *South Dakota.

Project descriptions and lists of hydrologic-data stations are presented to show the status of the U.S. Geological Survey water-resources studies in South Dakota. (USGS)
W84-00827

LONG RANGE PLANS FOR HYDROLOGIC INVESTIGATIONS,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 6B.
W84-00852

AN EVALUATION OF IDAHO STREAM-GAGING NETWORKS,
Geological Survey, Boise, ID. Water Resources Div.
E. W. Quillan, and W. A. Harenberg.
Available from the OFSS, USGS, Lakewood, CO 80225, Price $7.75 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-865, October 1982. 57 p, 74 Fig, 9 Tab, 14 Ref.

Descriptors: Surface water, *Gaging stations, *Network design, Cost analysis, *Idaho, Field trip routes.

Network Analysis for Regional Information (NARI) and the Cost-Effectiveness Procedure were tested by applying them to stream-gaging networks in Idaho. NARI was used to determine network design strategies that would maximize the value of additional data. Value of data was measured as the decrease in the probable true standards error of regional regression equations. NARI indicated that no significant decrease in regression error can be achieved by the collection of addition-

al data and that better models should be sought. No major modifications to NARI are necessary to make it widely applicable. The Cost-Effectiveness Procedure was used to determine optimal network operation strategies. It showed network uncertainty can be reduced when six- or one-visit per year minimum constraints are in force. Sensitivity to various cost factors was examined. Attempts to model networks that included sites for collection of groundwater and water-quality data were unsuccessful. (USGS)
W84-00866

7B. Data Acquisition

INSTALLATION AND SERVICE MANUAL FOR U.S. GEOLOGICAL SURVEY MANOMETERS,
Geological Survey, Reston, VA.
J. D. Craig.
Available from the Eastern Distribution Br. USGS, 604 S. Pickett St. Alexandria, VA 22304. USGS Techniques of Water-Resources Investigations, Book 8, Instrumentation, Chapter 2A, 1983. 57 p, 25 Fig.

Descriptors: *Bubble gages, *Manometers, Water-level gages, STACOM Manometer, Screw-type manometer, *Instrumentation.

This manual describes the installation, operation, and maintainance of the bubble-gage manometers currently used by the U.S. Geological Survey. Other applications of these devices, such as the long manometer and differential manometer, are discussed, and accessories available for them are described. The bubble gage (water-stage manometer with gas-purge system) described in the Installation and Service Manual, October 1962, has been extensively modified and developed into the STACOM device. This chapter is the manual for the STACOM unit and an update of the manual for the screw-type bubble gage. A parts list is included for both units. (USGS)
W84-00811

HYDRAULIC CONSIDERATIONS IN SAMPLING THE UNSATURATED ZONE WITH INCLINED GRAVITY LYSIMETERS,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2G.
W84-01018

MEASUREMENT AND COMPUTATION OF STREAMFLOW: VOLUME 1. MEASUREMENT OF STAGE AND DISCHARGE,
Geological Survey, Menlo Park, CA. Water Resources Div.
S. E. Rantz.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $13.00 per set. USGS Water Supply Paper 2175, 1982. 284 p, 138 Fig, 15 Tab, 69 Ref.

Descriptors: *Discharge(Water), *Discharge measurement, *Stage discharge relations, *Water levels, Backwater, Current meters, Ice cover, Open-channel flow, Peak discharge, Pipe flow, Stream gages, Tidal streams, Water level recorders, *Streamgage controls, Acoustic-velocity meters, Deflections meters, Discharge-rating shifts, Sand channels, Slope.

This stream-gaging manual, in two volumes, describes the equipment and technical work involved in obtaining systematic records of streamflow. The subject is treated in accordance with six major topics. Volume 1, titled 'Fieldwork', covers (1) selection of gaging-station sites, (2) measurement of stage, and (3) measurement of discharge. In order to make the text as broadly as possible, discussions of instrumentation and measurement are aimed at the technician, and discussions of instrumentation of computational procedure are aimed at the junior engineer who has background in basic hydraulics. The section on the design of gaging-station networks is written for the experienced hydrologist who plans such networks. (USGS)
W84-01048

7C. Evaluation, Processing and Publication

FLOOD OF JUNE 13-15, 1981, IN THE BLANCHARD RIVER BASIN, NORTHWESTERN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
E. E. Webber.
USGS Water-Resources Investigations 82-4044, 1982. 32 p, 16 Fig, 5 Tab, 4 Ref.

Descriptors: *Flood data, *Flood profiles, Floods, Flood recurrence interval, Rainstorms, Blanchard River Basin, *Ohio.

The flood of June 13-15, 1981, in the Blachard River Basin in Northwestern Ohio caused major damage in Findlay, Ottawa, and adjacent rural areas. Approximately 25% of Findlay and 55% of Ottawa were flooded. Estimated crop damage was $12 million in Hancock County, $7 million in Wyandot County, and $3 million in Putnam County. During the 1981 flood, the maximum gage height of the Blanchard River at Findlay was 17.43 feet, gage datum. This was 0.67 foot higher than the previous peak of record of 16.76 feet that occurred February 11, 1959. The corresponding peak discharge, 13,000 cubic feet per second, was estimated to have a recurrence interval of 50 years. Recurrence intervals of peak flows at other locations on the Blanchard River and on tributary streams were estimated to range from 25 to more than 100 years. Records of precipitation, peak and daily stream discharges, and minimum stream level profiles are given. (USGS)
W84-00777

GEOLOGY AND GROUND WATER RESOURCES OF SUSSEX COUNTY AND THE WARREN COUNTY PORTION OF THE TOCKS ISLAND IMPACT AREA,
New Jersey Bureau of Geology and Topography, Trenton.
For primary bibliographic entry see Field 2F.
W84-00783

WATER RESOURCES RESUME: STATE ATLAS SHEET NO. 23, PARTS OF BERGEN, MORRIS AND PASSAIC COUNTIES,
New Jersey Bureau of Geology and Topography, Trenton.
K. Widmer, H. Kasabach, and P. Nordstrom.
New Jersey Geological Survey, Geologic Report Series No 10, 1966. 34 p, 4 Fig, 2 Append.

Descriptors: *Geologic formations, *Water supply, *Wells, *Groundwater availability, Physiographic provinces, Catchment areas, Watersheds, Topography, Surface water, Drilling, *Atlas, *New Jersey, Bergen County, Morris County, Passaic County.

The text, when used with an accompanying overlay and State Topographic Atlas Sheet, will provide a convenient source of information as to the availability of groundwater, major surface water supplies, topography, and other essential factors which affect the water resources in the various counties and municipalities of the northeastern part of New Jersey. The report has been compiled from records available in the Bureau of Geology. It includes a list of 280 wells. Public water supply wells giving more than 100,000 gallons per day, as well as all private wells of similar capacity whose records are on file with the Department of Conservation and Economic Development, have been plotted on the overlay. Within the Atlas Sheet 23 area, there are over 275 wells. The majority of these wells, at the time they were drilled, had a capability in excess of 300,000 gallons per day. Five geologic formations in the study area must be considered when drilling a well. Four are shown on the overlay map, while the fifth, the Pleistocene deposits, must be considered separately as a potential source of water in restricted areas. Successful wells in any of the geologic formations are completed within 400 feet of the surface. Nearly all of the area east of Saddle River is within the franchise area of the Hackensack Water Company. The surface water resources of the Hackensack Basin are completely developed. (Fazio-Omniplan)
W84-00792

STATISTICAL SUMMARIES OF NEW JERSEY STREAMFLOW RECORDS,
S. L. Laskowski.
Water Resources Circular 23, New Jersey Dept. of Environmental Protection, Trenton, 1970. 264 p, 3 Fig, 21 Ref, 1 Append.

Descriptors: *Daily hydrographs, *Data acquisition, *Hydrologic data collections, *Statistical analysis, *Stream discharge, *Stream gages, *On-site data collection, Gages, Flow, Statistical methods, Statistics, Parametric hydrology, Data collections, *New Jersey.

The records for 79 of approximately 100 stream-gaging stations presently or previously operated in New Jersey, plus records for three stations in Pennsylvania, and one in New York are presented in summarized form. In addition to including a greater number of stations in this report, more years of record and more tables are listed for each station than in the 1958 report. A description of the station, three arrangements of data summarizing the daily flow records, and one table listing statistics of the monthly mean flows are provided. No data representing instantaneous extreme flows are given. Plotting positions for the three types of curves describing the characteristics of daily discharge are listed for each station. Statistical parameters are also presented so that alternate curves may be drawn. All stations included in this report have five or more years of record. The data presented are based on observed flow past the gaging station. Since any streamflow record is a sample in time, the data derived from these records can provide only a guide to expected future flows. For this reason the flow records are analyzed by statistical techniques, and the magnitude of sampling errors should be recognized. These analyzed data will be useful to a large number of municipal, state, and federal agencies; industries; utilities; engineers; and hydrologists concerned with the availability, conservation, control, and use of surface waters. The tabulated data and curves can be used to select sites for water supplies and to determine flood or drought storage requirements. The statistical values presented herein can be used in computer programs. (Garrison-Omniplan)
W84-00800

SEMIANNUAL WATER-LEVEL AND POTENTIOMETRIC CONTOURS OF TWO WATER-YIELDING ZONES IN THE SURFICIAL AQUIFER, 1975-79, NAPLES, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. C. Buchmiller.
USGS Open-File Report 82-120, 1982. 2 Maps, 25 Fig, 2 Tab, 6 Ref.

Descriptors: *Aquifers, *Potentiometric levels, *Water level fluctuations, Water supply, Water table, *Maps, *Florida, Collier County, Naples.

Potable ground water in the Naples area along the coastal ridge of western Collier County, Florida, is available from two principal sources--the water-table zone and the pumped zone, both within the surficial aquifer. The primary source of public supply is from the pumped zone, locally known as the Coastal Ridge aquifer. Water levels in wells in the pumped zone respond rapidly to pumpage and usually indicate a cone of depression in most of the highly urbanized Naples area. The cone of depression caused by pumpage has created significant water-level differences between the water-table zone and pumped zone. Water-level differences in the two zones from 1975 to 1979 frequently exceed 10 feet. The maps have been drawn to be representative of hydrologic conditions in both zones for the wet and dry seasons from 1975-79. (USGS)
W84-00803

SATURATED THICKNESS OF THE HIGH PLAINS REGIONAL AQUIFER IN 1980, NORTHWESTERN OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
J. S. Havens.
USGS Water Resources Investigations Open-File Report 82-760, September 1982. 2 Sheets, 7 Ref.

Descriptors: *Groundwater, *Aquifers, Saturation, Bedrock, *Oklahoma, *High Plains Regional Aquifer System, *Maps.

The High Plains aquifer in Oklahoma is part of regional aquifer system extending from South Dakota southward to Texas and New Mexico. The principal aquifer, the Ogallala Formation of Tertiary age, is hydraulically connected with other unconsolidated deposits, principally of Quaternary age. During 1978, the U.S. Geological Survey began a 5-year study of the High Plains regional aquifer system to provide hydrologic information for evaluation of the aquifer and to develop and evaluate predictive computer models of it. This report consists of two maps showing the 1980 saturated thickness of the High Plains regional aquifer in northwestern Oklahoma. The saturated thickness was derived from published reports showing the aquifer base and the 1980 water table; the difference in altitude between these two surfaces gives the saturated thickness of the aquifer. (USGS)
W84-00804

CHEMICAL QUALITY OF WATER IN THE UPPER PART OF THE FLORIDIAN AQUIFER, DUVAL COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. Thompson.
USGS Water Resources Investigation Open-File Report 82-119, 1982. 1 Map, 5 Fig, 1 Tab, 10 Ref.

Descriptors: *Groundwater, *Water quality, *Florida, Chlorides, Dissolved solids, Hardness(Water), Atlantic Coastal Plain, Floridian Aquifer, Chemical water types, Duval County, Water chemistry, *Maps.

Between 1977 and 1980, water samples from 211 wells that penetrate as much as 900 feet of the upper part of the Floridian aquifer were analyzed for major inorganic ions. Maps show the areal distribution of dissolved solids, total and noncarbonate hardness, chloride, and chemical water types. Variation in water quality with aquifer depth was not considered. In general, the concentrations of the constituents were lowest in the southwest area of the county, and highest in the southeast. Ranges of concentrations (in milligrams per liter) were: dissolved solids, less than 200 to as much as 623; total hardness as calcium carbonate, less than 200 to as much as 430; and chloride, less than 10 to as much as 210. Noncarbonate hardness ranged from less than 30 to as much as 70% of the total hardness. Six chemical types were defined, based upon the predominant cations and anions. The most prominent type was a calcium sulfate mass extending into central Duval County from the southeast. Calcium bicarbonate and calcium-magnesium bicarbonate types were found in most of the rest of the county. (USGS)
W84-00806

MAP SHOWING GROUNDWATER CONDITIONS IN THE TONTO BASIN AREA, GILA COUNTY, ARIZONA--1979,
Geological Survey, Phoenix, AZ. Water Resources Div.
E. E. Denis.
USGS Water-Resources Investigations/Open-File Report 82-116, December 1981. 1 Map, 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Groundwater, *Water levels, *Water quality, Water wells, *Maps, *Arizona, Gila County, Tonto basin area.

The Tonto basin area includes about 955 square miles in central Arizona. The rocks in the Tonto basin area are divided into four water-bearing units: alluvium, basin fill, consolidated sedimentary rocks, and igneous and metamorphic rocks. The water-bearing characteristics of the rocks may vary greatly within the boundaries of a unit and between units because of complex faulting or fracturing, and because of the relative topographic positions of the units. Information shown on the map includes altitude of the water level, depth to water, well depth, spring discharge, specific conductance, and fluoride concentration. Scale 1:125,000. (USGS)
W84-00807

THE BENCHMARK FARM PROGRAM-- A METHOD FOR ESTIMATING IRRIGATION WATER USE IN SOUTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
A. D. Duerr, and J. T. Trommer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-224197, Price codes: A04 in paper copy, A01 in microfiche. USGS Water Resources Investigations 82-17, 1982. 49 p, 14 Fig, 4 Tab, 10 Ref.

Descriptors: *Irrigation water, *Water use, Crops, Irrigation systems, Southwest Florida Water Management District, *Florida.

Irrigation water-use data are summarized in this report for 74 farms in the Southwest Florida Water Management District. Most data are for 1978-90, but 18 farms have data extending back to the early 1970's. Data include site number and location, season and year, crop type, irrigation system, monitoring method, and inches of water applied per acre. Crop types include citrus, cucumbers, pasture, peanuts, sod, strawberries, and tropical fish farms are also included. Water-application rates per growing season ranged from 0 inches per acre for several citrus and pasture sites to 239.7 inches per acre for a nursery site. The report also includes rainfall data for 12 stations throughout the study area. (USGS)
W84-00808

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, MAY 1982,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. R. Schiner, and E. C. Hayes.
Available from the OFSS, USGS Lakewood, CO 80225, Price: $3.50 in paper copy, $1.00 in microfiche. USGS Open-File Report 82-915, 1982. 1 Sheet, 1 Fig.

Descriptors: *Potentiometric level, Groundwater, Hydrologic aspects, Aquifer, Hydrogeology, *Florida, St. Johns River Water Management District, *Maps.

This map presents the potentiometric surface of the Floridan aquifer in the St. Johns River Water Management District and vicinity for May 1982. The Floridan aquifer is the principal source of potable water in the area. Water-level measurements were made on approximately 1,000 wells and on several springs. The potentiometric surface is shown mostly by 5-foot contour intervals. In the Fernandina Beach area 20-foot intervals are used to show a deep cone of depression. The potentiometric surface ranged from 128 feet above NGVD (National Geodetic Vertical Datum of 1929) in Polk County to 68 feet below NGVD in Nassau County. Because of above average rainfall, water levels began to recover from record low levels set in September 1981 in many counties. Except in a few places, water levels throughout the District rose above May 1981 levels. May 1982 levels were as much as 9 feet and commonly 1 to 3 feet higher than the below normal May 1981 levels. (USGS)
W84-00819

MAP OF THE ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA, SHOWING GROUND-WATER SUBUNITS AND AREAS, AND WELL HYDROGRAPHS, 1962 TO 1982,
Geological Survey, Menlo Park, CA. Water Resources Div.
F. M. Glenn.
USGS Open-File Report 821-917, 1982. 1 Sheet, 3 Ref.

Descriptors: *Water-level hydrographs, *Groundwater, Antelope Valley-East Kern Area, *California, *Maps.

A map (scale 1:62,500) shows ground-water subunits and areas, and well hydrographs for 1962 to 1982, in the Antelope Valley-East Kern Water Agency area, California. (USGS)
W84-00820

PERCENTAGE CHANGE IN SATURATED THICKNESS OF THE HIGH PLAINS AQUIFER, WEST-CENTRAL KANSAS, 1950 TO AVERAGE 1980-82,
Geological Survey, Lawrence, KS. Water Resources Div.
M. E. Pabst.
Available from OFSS, USGS, Fed. Ctr. Lakewood, CO 80225, Price: $4.50 in paper copy, $1.00 in microfiche. USGS Open-File Report 82-1010, 1982. 1 sheet, 1 Fig, 9 Ref.

Descriptors: *Approximation method, *Hydrologic data, *High Plains Aquifer, Water distribution(applied), Water management(applied), *Kriging, *Kansas, Colorado, *Maps.

A statistical technique, called kriging, was programmed for a computer to interpolate hydrologic data based on a network of 296 measured values in west-central Kansas and eastern Colorado. The computer program generated estimated values of selected hydrologic data at the center of each 1-mile section in the Western Kansas Groundwater Management District No. 1. This program facilitated contouring of the data that are needed to aid in the management of ground water for irrigation. The kriging technique produced a map that illustrates the percentage change in saturated thickness of the High Plains aquifer from 1950 to average 1980-82 in west-central Kansas. Estimated changes in saturated thickness of the aquifer, as shown on the map, range from about a 50% increase to a 100% decrease. (USGS)
W84-00821

DRAINAGE DIVIDES, MASSACHUSETTS--NASHUA AND CONCORD RIVER BASINS,
R. A. Brackley, and S. W. Wandle, Jr.
USGS Open-File Report 82-924, 1982. 3 p, 22 Maps.

Descriptors: *Drainage basins, Surface waters, *Massachusetts, Sites, *Hydrologic data, *Maps, Nashua River, Sudbury River, Assabet River, Concord River, Merrimack River, Middlesex, Western Essex, Eastern Worcester counties.

Drainage boundaries for selected subbasins of the Nashua and Concord River basins in Middlesex, western Essex, and eastern Worcester Counties, Massachusetts, are delineated on 22 topographic quadrangle maps at a scale of 1:24,000. Drainage basins are shown for all U.S. Geological Survey data-collection sites and for mouths of major rivers. Drainage basins are shown for the outlets of lakes or ponds and for streams where the drainage area is greater than 3 square miles. Successive sites along watercourses are indicated where the intervening area is at least 6 square miles on tributary streams or 10 square miles along the Assabet River, Concord River, Merrimack River, Nashua River, or Sudbury River. (USGS)
W84-00822

ANNUAL SUMMARY OF GROUND-WATER CONDITIONS IN ARIZONA, SPRING 1981 TO SPRING 1982,
Geological Survey, Tucson, AZ. Water Resources Div.
USGS Open-File Report 82-1009, February 1983. 2 Sheets, 5 Fig, 2 Tab, 19 Ref.

Descriptors: Water levels, *Water-level fluctuations, *Pumpage, Irrigation, *Arizona, Basin and

Range lowlands province, Central highlands province, Plateau uplands province, *Withdrawal, *Maps, *Groundwater.

The withdrawal of ground water was about 5.4 million acre-feet in Arizona in 1981, which is about 800,000 acre-feet more than the amount withdrawn in 1980. Most of the increase in 1981 was in the amount of ground water used for irrigation in the Basin and Range lowlands province. Through 1981, slightly more than 189 million acre-feet of ground water had been withdrawn from the ground-water reservoirs in Arizona. The report contains two small-scale maps that show groundwater pumpage by areas and the status of the ground-water inventory in the State. The main map, which is at a scale of 1:500,000, shows potential well production, depth to water in selected wells in spring 1982, and change in water level in selected wells from 1977 to 1982. A brief text summarizes the current ground-water conditions in the State. (USGS)
W84-00824

SELECTED HYDROLOGIC DATA, 1978-80, PRICE RIVER BASIN, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
K. M. Waddell, J. E. Dodge, D. W. Darby, and S. M. Theobald.
USGS Open File Report 82-916, 1982. 73 p, 13 Fig, 22 Tab, 3 Ref.

Descriptors: Water resources, Utah, Hydrologic data, Climatic data, Groundwater, Price River basin, *Utah.

This report presents data collected in the coal fields of the Wasatch Plateau and Book Cliffs in the Price River basin, east-central Utah. Ground- and surface-water and climatologic data that were collected during October 1978 to September 1980 are included in the report. Ground-water data include water levels in wells, discharges to springs and chemical analyses of water from wells, springs, and mines. Surface-water data include measurements of daily stream discharges at selected sites and analyses of the chemical, physical, and biological characteristics of water in streams and in Scofield Reservoir. Climatologic data include records of daily precipitation and solar radiation. Also included in the report are mineralogic and particle-size analyses of streambed samples, analyses of benthic invertebrates at selected stream sites, and analyses of suspended stream runoff in Soldier Creek. (USGS)
W84-00825

EFFECTS OF URBANIZATION ON THE MAGNITUDE AND FREQUENCY OF FLOODS ON SMALL STREAMS IN TENNESSEE-BASIC DATA REPORT NO. 2,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 4C.
W84-00826

SEMI-VARIOGRAM ESTIMATION AND UNIVERSAL KRIGING PROGRAM (COMPUTER PROGRAM DOCUMENTATION, USER'S MANUAL),
Geological Survey, Tacoma, WA. Water Resources Div.
J. A. Skrivan, and M. R. Karlinger.
USGS Computer Contribution Report, 1979. 122 p, 16 Ref.

Descriptors: *Statistical estimating analysis, *Regional analysis, *Networks, *Kriging, Universal kriging, *Variogram, Semi-variogram, Geostatistics, Interpolation, Stochastic interpolation, Block kriging, Drift estimation, Autocorrelation, Information value.

Program K603 contains procedures necessary for the stochastic-interpolation algorithm known as universal kriging, as originally described by G. Matheron. By specifying a theoretical semi-variogram and functional terms of an assumed underlying trend, or drift, kriging provides unbiased estimates of values of variables in neighborhoods of autocorrelation. Given single observations and their spatial or temporal distribution the technique yields point estimate variances at arbitrary locations. In the absence of measurement errors, which can be incorporated in the analysis, kriging is an exact interpolator. The program includes four procedures used in kriging: (1) semi-variogram estimation; (2) universal kriging for optimization of the drift-variogram set; (3) universal kriging for arbitrary point or block estimation; and (4) universal kriging for drift-coefficient estimation. In addition, an option to apply kriging in block-estimation problems is also included. (USGS)
W84-00829

GROUND-WATER DATA FROM SELECTED WELLS IN ALLUVIAL AQUIFERS, POWDER RIVER BASIN, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
D. K. Well.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $16.00 in paper copy, $4.00 in microfiche. USGS Open-File Report 82-856, 1982. 39 p, 1 Fig, 31 Tab, 4 Ref.

Descriptors: *Chemical analyses, Drillers logs, *Groundwater data, *Water quality, Powder River basin, *Wyoming, Alluvial aquifers, Well records.

Data on selected wells completed in alluvial aquifers in the Powder River structural basin in northeastern Wyoming are presented without interpretation. Records of 300 wells, chemical analyses of water from 43 wells, and logs of 113 wells are listed in three tables. A map showing location of wells is included. (USGS)
W84-00830

HYDROGRAPHS OF WATER LEVELS IN OBSERVATION WELLS IN IDAHO, 1971-82,
Geological Survey, Boise, ID. Water Resources Div.
H. W. Young.
USGS Open-File Report 83-225, 1983. 282 p, 8 Fig, 1 Ref.

Descriptors: *Water-level fluctuations, *Groundwater, *Water levels, *Groundwater depletion, *Idaho.

For the period 1971-82, this report presents hydrographs of water levels in observation wells in the Statewide monitoring network operated by the U.S. Geological Survey in cooperation with the Idaho Department of Water Reources. The data are conveniently made available to supplement an interpretive report that describes Statewide water-level trends and their causes, which will be published separately.
W84-00831

DRAINAGE DIVIDES, MASSACHUSETTS--IPSWICH AND LOWER MERRIMACK RIVER BASINS AND NORTHEAST COASTAL BASINS,
Geological Survey, Boston, MA. Water Resources Div.
R. A. Brackley, and S. W. Wandle, Jr.
USGS Open-File Report 83-209, 1983. 2 p, 28 Maps.

Descriptors: *Ipswich River, Parker River, Mystic River, Shawsheen River, *Merrimack River, Neponset River, Charles River, Essex, Eastern Middlesex, Eastern Norfolk, Northern Plymouth, and Suffolk counties, *Massachusetts.

Drainage boundaries for selected subbasins of the Ipswich and lower Merrimack River Basins and Northeast Coastal Basins in Essex, Eastern Middlesex, Eastern Norfolk, Northern Plymouth, Suffolk Counties, Massachusetts, are delineated on 28 topographic quadrangle maps at a scale of 1:24,000. Drainage basins are shown for all U.S. Geological Survey data-collection sites and for mouths of major rivers. Drainage basins are shown for the outlets of lakes or ponds and for streams where the drainage area is greater than 3 square miles. Successive sites along watercourses are indicated where the intervening area is at least 6 square miles on tributary streams or 10 square miles along the Charles River, Ipswich River, Merrimack River, Mystic River, Neponset River, Parker River, or Shawsheen River. (USGS)
W84-00833

COMPILATION OF GROUND-WATER QUALITY DATA FOR SELECTED WELLS IN ELMORE, OWYHEE, ADA, AND CANYON COUNTIES, IDAHO, 1945 THROUGH 1982,
Geological Survey, Boise, ID. Water Resources Div.
D. J. Parliman.
Available from the OFSS, USGS, Box 25, Denver, CO 80225, Price: $20.25 in paper copy, $3.50 in microfiche. USGS Open-File Report 83-39, September 1982. 152 p, 8 Fig, 2 Tab, 5 Ref.

Descriptors: Geologic units, Well water, *Well data, *Groundwater, *Water quality data, Ada County, Canyon County, Elmore County, Owyhee County, Snake River Basin, Western Snake River Plain, *Idaho.

Well-inventory and groundwater-quality data for 665 sites with a total of 1,318 chemical analyses were compiled from Elmore, Owyhee, Ada, and Canyon Counties. Data are sorted by water temperature (less than 20 degrees Celsius is considered nonthermal; 20 degrees Celcius or greater is considered thermal) to facilitate their use. (USGS)
W84-00834

FUNDING HISTORY OF THE U.S. GEOLOGICAL SURVEY FEDERAL DATA COLLECTION AND ANALYSIS PROGRAM,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 9D.
W84-00836

FLOODS OF NOVEMBER 1978 TO MARCH 1979 IN ARIZONA AND WEST-CENTRAL NEW MEXICO,
Geological Survey, Tucson, AZ. Water Resources Div.
B. N. Aldridge, and T. A. Hales.
USGS Open-File Report 83-201, April 1983. 168 p, 13 Fig, 10 Tab, 38 Ref.

Descriptors: *Floods, *Flood damage, Hydrographs, *Peak discharges, *Regulated flow, *Reservoir storage, Discharge(Water), Historic floods, Precipitation(Atmospheric), Reservoir operation, Stream erosion, Streamflow, Surface runoff, Traveltime(Floods), *Gila River, Little Colorado River Maricopa County, Phoenix, Salt River, Santa Cruz River, San Pedro River, Verde River, San Francisco River, Duncan, Clifton, Safford, Winslow, Gila Hot Springs, *Arizona, *New Mexico.

Widespread rainfall of 3 to 9 inches in the mountains area of Arizona and West-Central New Mexico during December 17-20, 1978, caused maximum known discharges on the Gila River in New Mexico and on several streams in Arizona. At Phoenix, the Salt River was the highest since 1920 but was only slightly higher than the flood in March 1978. The Agua Fria River was the highest since 1919. The floods caused 12 deaths and more than $150 million in damage. Damage of $51.8 million occurred in Maricopa County, Arizona. Ten counties in Arizona and three counties in New Mexico wer declared disaster areas. Unusually high volumes of runoff occurred on the Salt, Verde, and Agua Fria Rivers upstream from reservoirs. Overflow from the reservoir systems caused flooding downstream. Storage in the reservoirs on the Salt and Verde River reduced the peak discharge of the Salt River at Phoenix from a potential of about 234,000 cubic feet per second to 126,00 cubic feet per second and greatly reduced the duration of the flood. (USGS)
W84-00837

RAINFALL-RUNOFF DATA FROM SMALL WATERSHEDS IN COLORADO, OCTOBER 1977 THROUGH SEPTEMBER 1980,
Geological Survey, Lakewood, CO. Water Resources Div.
B. J. Cochran, D. R. Minges, D. Jarrett, and J. E. Veenhuis.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $98.00 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-873, 1983. 748 p, 3 Fig, 4 Tab, 17 Ref.

Descriptors: Floodwater, Hydrographs, *Rainfall-runoff relationships, Runoff coefficient, *Small watersheds, Storm runoff, Surface runoff, Time of concentration, Unit hydrographs, Cloudbursts, Rainfall, Rainfall intensity, Flash floods, Precipitation intensity, *Data collection, *Colorado, Denver, Boulder, South Platte River basin, Arkansas River basin, Colorado River basin.

Rainfall-runoff data from small watersheds in Colorado are being collected and analyzed for the purpose of defining the flood characteristics of these and other similar areas. Rainfall-runoff collected from October 1977 through September 1980 at a total of 37 urban stations, 10 Denver Federal Center stations, and 41 rural (or highway) stations are presented in tabular form along with station descriptions and methods of data collection and analysis. (USGS)
W84-00858

HYDROLOGIC DATA FOR URBAN STORM RUNOFF IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. W. Gibb, and J. T. Doerfer.
Available from the OFSS, USGS, Lakewood CO 80225, Price: $77.50 in paper copy, $4.50 in microfiche. USGS Open-File Report 82-872, September 1982. 553 p, 3 Fig, 380 Tab, 9 Ref.

Descriptors: *Storm runoff, *Rainfall-runoff relationships, Rainfall-runoff modeling data, Water-quality data, Rainfall-runoff simulation data, *Hydrologic data, *Urban runoff, *Colorado, Denver Metropolitan area, Denver Regional Council of Governments, South Platte River.

Urban storm-runoff data collected from April through September 1981 from nine Denver Nationwide Urban Runoff Program sites, urban storm-runoff data collected from April 1980 through September 1981 from ten South Platte River Study sites, and rainfall-runoff simulation data from two sites for June 1980 and May 1981 are presented in this report. The Denver Nationwide Urban Runoff Program sites were two single-family residential areas, two multifamily residential areas, one commercial area (shopping center), one mixed commercial and multifamily residential area, one natural area (open space), and two detention ponds. The South Platte River Study sites were six tributaries of the South Platte River and four in-stream sites on the South Platte River. The tributary sites were Bear Creek at mouth, at Sheridan; Harvard Gulch at Harvard Park, at Denver; Sanderson Gulch at mouth, at Denver; Weir Gulch at mouth, at Denver; Lakewood Gulch at mouth, at Denver; and Cherry Creek at Denver. The in-stream sites were South Platte River at Littleton; South Platte River at Florida Avenue, at Denver; South Platte River at Denver; and South Platte River at 50th Avenue, at Denver. The rainfall-runoff simulation sites were North Avenue at Denver Federal Center, at Lakewood and Rooney Gulch at Rooney Ranch, near Morrison. Precipitation, rainfall-runoff, water-quality data, and basin characteristics were collected at the urban storm-runoff sites. The urban storm-runoff data may be used to characterize runoff loading for various land-use types in Denver and other semiarid regions. (USGS)
W84-00859

WATER QUALITY OF THE POTOMAC RIVER AT CHAIN BRIDGE AT WASHINGTON, D.C., HYDROLOGIC DATA REPORT, 1978 WATER YEAR,
Geological Survey, Reston, VA. Water Resources Div.
S. F. Blanchard.
USGS Open-File Report 83-147, 10 p, 2 Fig, 2 Tab, 4 Ref.

Descriptors: *Water quality data, *Hydrologic data, *Potomac River, Potomac estuary study.

Water quality data are presented, measured at the Potomac River at Chain Bridge at Washington, D.C. for the 1978 water year. Samples were generally collected twice a week and more frequently during periods of high flow. The samples were analyzed for nitrogen, phosphorus, silica and suspended sediments. (USGS)
W84-00861

WATER-RESOURCES INVESTIGATIONS OF THE U. S. GEOLOGICAL SURVEY IN MISSOURI, FISCAL YEAR 1983,
Geological Survey, Rolla, MO. Water Resources Div.
W. M. Kratzer.
USGS Open-File Report 83-251, 1983. 51 p, 3 Fig, 1 Tab, 150 Ref.

Descriptors: *Missouri, *Hydrologic-data program, Networks, Streamflow-gaging stations, *Data collection, District projects, Hydrologic reports.

Water-resources investigations of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and making interpretive investigations. These data and the results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. This report describes the data-collection activities and investigations in Missouri for the 1983 fiscal year and provides an extensive list of water-resources references for the State of Missouri. (USGS)
W84-00862

SELECTIVE ANNOTATED BIBLIOGRAPHY OF GROUND-WATER RESOURCES, RECORDS OF WELLS AND SPRINGS, AND AVAILABILITY OF STREAMFLOW DATA ON INDIAN RESERVATIONS IN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
G. W. Levings, and M. K. White.
USGS Open-File Report 83-129, March 1983. 141 p, 4 Fig, 61 Ref.

Descriptors: *Groundwater, Surface water, *Indian Reservations, *Hydrologic data, *Data collection, *Montana, Blackfeet Indian Reservation, Crow Indian Reservation, Flathead Indian Reservation, Northern Cheyenne Indian Reservation, Rocky Boys Indian Reservation.

A compilation was made, for each of the seven Indian reservations in Montana, of the availability of hydrologic data. The report consists of an annotated bibliography of ground-water resources reports, selected data for wells and springs from the data bases of the U.S. Geological Survey and Montana Bureau of Mines and Geology, and a listing of all sites where streamflow has been measured and water-quality samples collected by the U. S.Geological Survey. (USGS)
W84-00863

GEOHYDROLOGIC DATA FROM SANDSTONE AQUIFERS IN SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
J. Kume, and J. M. Spinazola.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $15.00 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-868, 1982, 112 p, 3 Fig, 6 Tab, 20 Ref.

Descriptors: *Hydrologic data, Sandstones, *Aquifers, Geology, Lithologic logs, Chemical analysis, Water level, *Sandstone aquifers, *Kansas.

Data collected during a reconnaissance investigation of the geology and hydrology of sandstone aquifers provide useful information in the study of, and planning for, water-resources development in a 17,400 square-mile area in 26 counties of southwestern Kansas. The aquifers consist chiefly of saturated sandstones that occur in Upper Permian, Upper Jurassic, and Lower and Upper Cretaceous rocks. In parts of southwestern Kansas, the sandstone aquifers already serve as the principal or secondary source of ground water for irrigation and other uses. Data indicate that water may be available for development in sandstone aquifers in other parts of the study area. In still other areas, water from wells in sandstone aquifers may not be of a suitable quality for some purposes. The data provided include records of selected wells, lithologic logs of test holes and wells, selected formation surfaces and sandstone thicknesses, chemical analyses of water from selected wells, and water levels in observation wells. (USGS)
W84-00864

GROUND-WATER LEVELS IN SELECTED WELL FIELDS AND IN WEST-CENTRAL FLORIDA, MAY 1982,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. L. Barr.
Available from the OFSS, USGS Lakewood, CO 80225, Price $7.00 in paper copy, $1.00 in microfiche. USGS Open-File Report 82-867, 1982. 2 Maps, 2 Tab, 2 Ref.

Descriptors: *Aquifers, *Groundwaters, Potentiometric level, Subsurface waters, *Water table, *Florida, Floridan aquifer, Surficial aquifer, *Maps.

The water table in the surficial aquifer and the potentiometric surface of the Floridan aquifer in a 1,700-square-mile area in west-central Florida are mapped semiannually by the U.S. Geological Survey. Maps are based on water levels measured in wells each May to coincide with the seasonal low levels and each September to coincide with seasonal high levels. The mapped area shows 14 well fields that supplied 181.1 million gallons to municipalities on May 10, 1982. The water is withdrawn from the Floridan aquifer, the major aquifer in Florida. The effect of localized withdrawal on ground water is shown on the maps as depressions in both the potentiometric and water-table surfaces. In May 1982, ground-water levels were lower than those of September 1981. Seasonal recharge from above-average rainfall and reduced pumpage aided in the water-level recovery from record to near record levels of May 1981. (USGS)
W84-00867

DRAINAGE DIVIDES, MASSACHUSETTS--TAUNTON RIVER BASIN AND SOUTHEAST COASTAL BASINS,
Geological Survey, Boston, MA. Water Resources Div.
S. Wandle, Jr., and M. H. Frimpter.
USGS Open-File Report, 82-870, 1982. 21 Maps, 2 Fig.

Descriptors: *Drainage basins, *Surface water, *Massachusetts, Sites, Hydrologic data, *Maps, Taunton River, Tenmile River, Charles River, Buzzards Bay tributaries, Mount Hope Bay tributaries, Narragansett Bay tributaries, Bristol.

Drainage boundaries for selected subbasins of the Taunton River basin and Southeast Coastal Basins in Bristol, western Norfolk, western Plymouth, southern Middlesex and eastern Worcester Counties, Massachusetts, are delineated on 24 topographic quadrangle maps at a scale of 1:24,000. Drainage basins are shown for all U.S. Geological Survey data-collection sites and for mouths of major rivers. Drainage basins are shown for the outlets of lakes or ponds and for streams where the drainage area is greater than 3 square miles. Successive sites along watercourses are indicated where the intervening area is at least 6 square miles on tributary streams or 10 square miles along the Charles River, Taunton River, or Tenmile River. (USGS)
W84-00868

STATISTICAL SUMMARIES OF SELECTED CHEMICAL CONSTITUENTS IN KANSAS GROUND-WATER SUPPLIES,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-00869

GROUND-WATER LEVELS IN ARKANSAS, SPRING 1982,
Geological Survey, Little Rock, AR. Water Resources Div.
J. Edds.
USGS Open-File Report 83-268, 1983. 49 p, 5 Fig, 15 Tab, 18 Ref.

Descriptors: *Groundwater level, Aquifers, Well hydrographs, Potentiometric level, *Arkansas, Alluvial aquifer, Sparta sand, Potentiometric-surface maps.

About 640 ground-water level measurements were made in observation wells in Arkansas in the spring of 1981. In addition, the report contains potentiometric-surface maps and well hydrographs relating to the alluvial aquifer and the Sparta Sand, the most important aquifers with respect to ground-water availability and use in Arkansas. (USGS)
W84-00870

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1981,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-00872

GROUND-WATER DATA FOR MICHIGAN, 1981,
Geological Survey, Lansing, MI. Water Resources Div.
G. C. Huffman.
USGS Open-File Report 82-754, 1982. 55 p, 22 Fig, 3 Tab, 90 Ref.

Descriptors: Water resources, *Groundwater, *Groundwater hydrographs, Water levels, Water use, Water quality, *Michigan.

This report summarizes data on water levels in 124 observation wells and provides information on well locations, depths, altitudes, and aquifers that they tap. Tabulated data include extremes of water levels for 1981 and for the period of record, pumpage of most major ground-water users in the State, and quality data on selected wells. The city of Lansing was the largest reported user of ground-water, pumping 8.6 billion gallons from the Saginaw Formation and glacial deposits. (USGS)
W84-00875

POTENTIOMETRIC-SURFACE MAP OF WATER IN THE JUDITH RIVER FORMATION IN THE NORTHERN GREAT PLAINS AREA OF MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
G. W. Levings.
Available from the USGS, OFSS Lakewood, CO 80225, Price: $2.25 in paper copy, $1.00 in microfiche. USGS Open-File Report 82-562, 1982. 1 Sheet map, 1 Fig, 7 Ref.

Descriptors: *Groundwater, *Potentiometric level, Aquifers, Judith River Formation, Northern Great Plains, *Montana, *Maps.

The potentiometric surface of the Judith River Formation is mapped at a scale of 1:1,000,000. The map is one of a series produced as part of a regional study of aquifers of Cenozoic and Mesozoic age in the northern Great Plains of Montana. The contour interval is 200 feet. Water in the Judith River Formation occurs under water-table and artesian conditions. The direction of regional ground-water movement is from west to east. Water is discharged from the Judith River Formation to the Milk River from near Havre, Montana, to Malta and to the Missouri River south of the Bearpaw and Little Rocky Mountains. The average discharge from 236 wells is about 10 gallons per minute, and the specific capacity of 186 wells averages 0.66 gallon per minute per foot of drawdown. (USGS)
W84-00877

POTENTIOMETRIC-SURFACE MAP OF WATER IN THE LAKOTA FORMATION AND EQUIVALENT UNITS IN THE NORTHERN GREAT PLAINS AREA OF MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
G. W. Levings.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $2.25 in paper copy, $1.00 in microfiche. USGS Open-File 82-563, 1982. 1 Sheet Map, 1 Fig, 4 Ref.

Descriptors: *Groundwater, *Potentiometric level, *Aquifers, Lakota Sandstone, Cut Bank Sandstone Member, Sunburst Sandstone Member, Moulton Member of Kootenai Formation, Third Cat Creek sandstone of Kootenai Formation, Pryor Conglomerate Member of Cloverly Formation, *Montana, *Maps.

The potentiometric surface of water in the lower Cretaceous Lakota Formation and equivalent units (Cut Bank Sandstone Member, Sunburst Sandstone Member, and Moulton Member of Kootenai formation; Third Cat Creek sandstone of Kootenai Formation; Pryor Conglomerate Member of Kootenai Formation) is shown on a base at a scale of 1:1,000,000. The map is one of a series produced as part of a regional study of aquifers of Cenozoic and Mesozoic age in the northern Great Plains of Montana. The contour interval is 200 feet. Water in the Lakota Formation and equivalent units occurs under water-table and artesian conditions. The direction of regional groundwater movement is east and north from the recharge areas in the Little Belt and Big Snowy Mountains. The average discharge from 20 wells is about 29 gallons per minute and the specific capacity of 18 wells averages 0.75 gallon per minute per foot of drawdown.
W84-00881

BASELINE WATER-QUALITY DATA FOR SAND-PLAIN AQUIFERS IN HUBBARD, MORRISON, OTTER TAIL, AND WADENA COUNTIES, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
C. F. Myette.
Available from the OFSS, USGS, Lakewood, CO 80225; Paper copy $14.25, Microfiche $3.50. USGS Open-File Report 82-909, October, 1982. 112 p, 2 Fig, 3 Tab, 5 Ref.

Descriptors: *Baseline studies, Water quality data, Sand aquifers, Hubbard County, Morrison County, Otter Tail County, Wadena County, *Minnesota, *Pollutant identification.

Tapping the surficial sand-plain aquifers in west-central Minnesota has raised the possibility for degradation of water quality. The sand-plain areas are generally overlain by sandy soils that permit rapid infiltration of precipitation and, possibly, of surface contaminants. One hundred twenty-five wells were sampled in Hubbard, Morrison, Otter Tail, and Wadena Counties during 1979-81 to establish regional baseline water quality. The wells were chosen to provide optimum areal coverage based on geology, direction of ground-water flow, and extent of aquifer development. Water from the sand-plain aquifers is of the calcium bicarbonate type. The water is hard to very hard with dissolved solids ranging from about 100 to 700 milligrams per liter. Locally, concentrations of dissolved solids, iron, manganese, and nitrate exceeded limits recommended by the Minnesota Pollution Control Agency. (USGS)
W84-00882

FLOODS OF DECEMBER 1982 AND JANUARY 1983 IN CENTRAL AND SOUTHERN MISSISSIPPI RIVER BASIN,
Geological Survey, Atlanta, GA. Water Resources Div.
V. B. Sauer, and J. M. Fulford.
USGS Open-File Report 83-213. 41 p, 14 Fig, 2 Tab, 10 Ref.

Descriptors: *Floods, *Flood data, *Regional floods, Flood hydrographs, Flood peak, Flood frequency, *Mississippi River Basin, Illinois, Missouri, Arkansas, Louisiana, Mississippi, Tennessee.

Widespread flooding occurred in December 1982, and January 1983, through a large part of the Central and Southern Mississippi River Basin. The States affected the most by these floods were Illinois, Missouri, Arkansas, Louisiana, Mississippi, and Tennessee. Two major storm periods occurred; one in early December and the other in late December. The early December storm resulted in outstanding floods mainly in Illinois, Missouri, and Arkansas. The late December storm produced major flooding mainly in Southeastern Arkansas, Louisiana, and Mississippi. Western Tennessee was on the fringes of both storms. Throughout the affected area for both storms, many streams exceeded previously known flood heights and discharges, and in many cases the recurrence interval of peak discharges exceeded 100 years. (USGS)
W84-00886

DISCHARGE DATA AT WATER-QUALITY MONITORING STATIONS IN ARKANSAS, 1980 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
R. K. Knott.
USGS Open-File Report 83-214, 1983. 36 p, 4 Tab.

Descriptors: *Streamflow, *Discharge measurement, *Arkansas, Water pollution control, Monitoring stations.

Discharge data were computed for a network of water-quality monitoring stations operated by the Arkansas Department of Pollution Control and Ecology (ADPC and E). All stations in the network were visited by Geological Survey personnel. Discharges on days of sampling were determined for 83 of the sites. A summary table of those discharges for the water year 1981 is given. Several discharges at three stations for miscellaneous dates in the 1980 water year are shown. Several discharges at four stations for miscellaneous dates in the 1979 year are shown. Several discharges at one station for miscellaneous dates in the 1978 water year are also shown. The letter-digit station numbers and names were devised and assigned by the ADPC and E. The corresponding eight-digit numbers are assigned downstream-order station numbers as used by the Geological Survey. (USGS)
W84-00887

RESULTS OF PESTICIDE SAMPLING IN TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
M. W. Gaydos.
Available from the OFSS, USGS, BOX 25, Denver, CO 80225, Price: $3.25 in paper copy, $4.00 in microfiche. USGS Open-File Report 83-148, 1983. 22 p, 1 Fig, 3 Tab, 3 Ref.

Descriptors: r samples, Bottom material samples, *Tennessee.

Pesticide data were collected at twelve sites in Tennessee between August 1979 and July 1982. Although pes
W84-00889

WATER-QUALITY DATA FOR SMITH AND BYBEE LAKES: PORTLAND, OREGON, JUNE TO NOVEMBER, 1982,
Geological Survey, Portland, OR. Water Resources Div.
D. G. Clifton.
USGS Open-File Report 83-204, 1983. 56 p, 5 Fig, 11 Tab, 23 Ref.

Descriptors: *Water quality, Limnology, *Bottom sediments, Smith Lake, Bybee Lake, Columbia Slough, *Oregon, Portland.

Water-quality monitoring at Smith and Bybee Lakes included measurement of water temperature, dissolved oxygen concentration and percent saturation, pH, specific conductance, lake depth, alkalinity, dissolved carbon, total dissolved solids, secchi disk light transparency, nutrients, and chlorophyll a and b. In addition, phytoplankton, zooplankton, and benthic invertebrate populations were identified and enumerated. Lakebed sediment was analyzed for particle size, volatile solids, immediate oxygen demand, trace metals, total organic carbon, nutrients, and organic constituents. (USGS)
W84-00890

REPORT OF THE ANNUAL YIELD OF THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS-OKLAHOMA, 1982 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
T. E. Lamb, and M. A. Moore.
Available from the OFSS, USGS, Box 25, Denver, CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. USGS Open-File Report 83-46, 1983. 25 p, 1 Fig, 3 Tab, 2 Ref.

Descriptors: Interstate compacts, *Arkansas, *Oklahoma, *Stream discharge, Reservoir storage, *Streamflow, Annual yield, River basin, *Arkansas River Basin.

The computed annual yield and deficiency of the subbasins as defined in the Arkansas River Compact, Arkansas-Oklahoma, are given in tables. Actual runoff from the subbasins and depletion caused by major reservoirs in the compact area are also given in tabular form. Monthly, maximum, minimum, and mean discharges are shown for the 14 streamflow stations used in computing annual yield. (USGS)
W84-00891

ESTIMATED WATER USE IN SOUTHWEST FLORIDA, 1981, AND SUMMARY OF ANNUAL WATER USE, 1970, 1975, AND 1977-81,
Geological Survey, Tallahassee, FL. Water Resources Div.
A. D. Duerr, and J. E. Sohm.
USGS Open-File Report 83-45, 1983. 75 p, 28 Fig, 9 Tab, 17 Ref.

Descriptors: *Water use, Irrigation water, Industrial water, Municipal water, *Estimated water use, *Florida, Southwest Florida Water Management District.

Water-use data for 1981 are summarized for 16 counties in the Southwest Florida Water Management District. Data include total use of groundwater and surface water for each of five water-use categories. The 1981 withdrawals for each category were as follows: 318 million gallons per day for public supply, 64 million gallons per day for rural, 314 million gallons per day for industrial, 595 million gallons per day for irrigation, and 7,680 million gallons per day for thermoelectric power generation of which 6,050 million gallons per day was saline water. (USGS)
W84-00892

ESTIMATED WATER USE IN MISSOURI, 1980,
Geological Survey, Rolla, MO. Water Resources Div.
M. Marikos, and J. Skelton.
Missouri Department of Natural Resources, Rolla, 1983. 1 Sheet Map, 14 Fig, 1 Tab, 7 Ref.

Descriptors: *Water use, *Consumptive use, Groundwater, Surface water, Irrigation, Industrial water use, *Maps, *Missouri, Public supply, Rural use, Thermoelectric use, Total use.

The map report summarizes 1980 water-use data for Missouri by counties for the following categories: public supply, rural (self-supplied), irrigation, thermoelectric, and industrial (self-supplied), irrigation, thermoelectric, and industrial (self-supplied). Total use during 1980 was about 6,345 million gallons per day. About 92.5% was withdrawn from surface-water sources and the rest from ground-water sources. Total water use increased by 81% during 1970-80, but population increased only about 5%. The major increase in use during 1970-80 was by thermoelectric powerplants, with small increases in public-supply withdrawals and irrigation. Rural and industrial use remained almost constant. (USGS)
W84-00894

TIME OF TRAVEL OF SELECTED ARKANSAS STREAMS,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 2E.
W84-00895

A TWO-DIMENSIONAL FINITE-ELEMENT MODEL STUDY OF BACKWATER AND FLOW DISTRIBUTION AT THE I-10 CROSSING OF THE PEARL RIVER NEAR SLIDELL, LOUISIANA,
Geological Survey, Bay Saint Louis, MS. Water Resources Div.
For primary bibliographic entry see Field 2A.
W84-00896

QUALITY-ASSURANCE DATA FOR ROUTINE WATER ANALYSIS IN THE LABORATORIES OF THE U.S. GEOLOGICAL SURVEY: 1981 ANNUAL REPORT,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W84-00897

CONSUMPTIVE USE OF FRESHWATER IN FLORIDA, 1980,
Geological Survey, Tallahassee, FL. Water Resources Div.
S. D. Leach.
Florida Department of Natural Resources, 1982. 1 Sheet Map, 7 Fig, 1 Tab, 5 Ref.

Descriptors: *Florida, *Water use, *Consumptive use, Freshwater, *Public supply, Rural water, Industrial water, Irrigation, Thermoelectric water use, Hydrology, *Maps.

Freshwater withdrawn in Florida for all uses averaged 7,309 million gallons per day (Mgal/d) in 1980. Of this amount, 4,831 Mgal/d was returned for reuse and 2,478 Mgal/d or one third of the freshwater withdrawn was consumed. The greatest use of freshwater was 2,997 Mgal/d prepared for irrigation, which had the greatest consumptive use of 1,547 Mgal/d, including an estimated 18 Mgal/d for conveyance loss. Consumptive use from irrigation was 62% of the total consumptive use statewide. Thermoelectric power generation, with an average withdrawal of 1,859 Mgal/d, was the second greatest user of freshwater, but had the least consumptive use of only 32.8 Mgal/d. The remaining consumptive use of freshwater amounted to 329 Mgal/d from public supplies, 102 Mgal/d from rural domestic and livestock use, and 467 Mgal/d from self-supplied industries. Consumptive use of water is a prime measure of the effect of water use upon the water budget in the State. As the total amount of freshwater withdrawn each year increases so will the amount of consumptive use. (USGS)
W84-00898

WATER QUALITY OF THE BARATARIA MARSH UNIT, JEAN LAFITTE NATIONAL HISTORIC PARK, LOUISIANA (APRIL 1981-MARCH 1982),
Geological Survey, Baton Rouge, LA. Water Resources Div.
C. R. Garrison.
USGS Open-File Report 82-691, 1982. 34 p, 2 Fig, 5 Tab, 16 Ref.

Descriptors: *Water quality, *Data collections, Physical analysis, Biological properties, *Data collections, Physical analysis, Biological properties, Chemical analysis, Nutrients, *Pesticides, Jean Lafitte National Historic Park, *Louisiana, Barataria, Westwego, Crown Point, Bayou Segnette, Kenta Canal, Millaudon Canal.

Surface-water samples were collected on a monthly basis for the period April 1981-March 1982 from six sites within the Barataria Marsh Unit of the Jean Lafitte National Historic Park, Louisiana. The sites were located on Bayou Segnette, Kenta Canal, and Millaudon Canal. Biological, chemical, and physical analyses were performed. Three of the sites were sampled quarterly for additional parameters including pesticides, metals, algal-growth potential, phytoplankton, benthic invertebrates, and grain size of bed material. The results of the analyses are presented without interpretation. (USGS)
W84-00900

GEOLOGIC AND WELL-CONSTRUCTION DATA FOR THE H-10 BOREHOLE COMPLEX NEAR THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 5E.
W84-00901

DRAINAGE DIVIDES, MASSACHUSETTS--CONNECTICUT RIVER LOWLANDS AND CHICOPEE RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
B. E. Krejmas, and S. W. Wandle, Jr.
USGS Open-File Report 82-633, 1982. 18 Sheet maps, 1 Fig.

Descriptors: *Drainage basins, *Surface waters, *Massachusetts, Sites, Hydrologic data, *Maps, *Connecticut River, Chicopee River, Franklin County, Hampshire County, Worcester County.

Drainage boundaries for selected subbasins of the Connecticut River lowlands and Chicopee River basin in southern Franklin, eastern Hampshire, and western Worcester Counties, Massachusetts, are delineated on 18 topographic quadrangle maps at a scale of 1:24,000. Drainage basins are shown for all U.S. Geological Survey data-collection sites and for mouths of major rivers. Drainage basins are shown for the outlets of lakes or ponds and for streams where the drainage area is greater than 3 square miles. Successive sites along watercourses are indicated where the intervening area is at least 6 square miles on tributary streams or 10 square miles along the Chicopee River, or 20 square miles along the Connecticut River. (USGS)
W84-00902

POTENTIOMETRIC-SURFACE MAP OF WATER IN THE FOX HILLS LOWER HELL CREEK AQUIFER IN THE NORTHERN GREAT PLAINS ARE OF MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
G. W. Levings.
Available from the USGS, OFSS, Lakewood, CO 80225, Printed copy $2.25, Microfiche $1.00. USGS Open-file Report 82-564, 1982. 1 Sheet maps, 1 Fig, 4 Ref.

Descriptors: *Groundwater, *Potentiometric level, *Aquifers, Fox Hill-lower Hell Creek aquifer, Fox Hills sandstone, Hell Creek formation, Northern Great Plains, *Montana, *Maps.

The potentiometric surface of water in the Upper Cretaceous Fox Hills-lower Hell Creek aquifer is shown on a base map at a scale of 1:1,000,000. The map is one of a series produced as part of regional study of aquifers of Cenozoic and Mesozoic age in the northern Great Plains of Montana. The contour interval is 100 feet. The map shows that the direction of regional ground-water movement is toward the northeast. Recharge occurs on the

flanks of the Black Hills uplift, the Cedar Creek anticline, the southwest part of the Bull Mountains basin, and on the out-crop areas. Discharge from the aquifer occurs along a short reach of the Yellowstone River. The average discharge from 335 wells is about 16 gallons per minute and the specific capacity of 185 wells averages 0.49 gallon per minute per foot of drawdown. (USGS)
W84-00903

DRAINAGE AREAS IN NEW JERSEY: DELAWARE RIVER BASIN AND STREAMS TRIBUTARY TO DELAWARE BAY,
Geological Survey, Trenton, NJ. Water Resources Div.
A. J. Velnich.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $6.50 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-572, August 1982. 48 p, 1 Fig, 3 Tab, 5 Ref.

Descriptors: *Drainage area, *Watersheds(Basin), Gaging stations, Rivers, Drainage system, Surface water, *Delaware River, *New Jersey, Basin characteristics, Stream gazaetteer.

Drainage areas of New Jersey streams tributary to the Delaware River and Delaware Bay are listed for over 1,100 sites. Tables show the descriptive location of each site, the latitude and longitude, county, and National Topographic map name. For gaged sites established through 1980, the U.S. Geological Survey station name and number are also listed. The data are presented alphabetically by stream name and in downstream order. Drainage areas were tabulated for most named streams and unnamed streams with a drainage area greater than 5 square miles. The methods used to delineate the drainage divides, measure areas, and determine mouths of streams follow the guidelines developed by the U.S. Water Resources Council. (USGS)
W84-00904

HYDROLOGY OF THE HAMILTON LAKES AND VICINITY, POLK COUNTY, CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. Anderson, and E. P. Simonds.
USGS Open-File Report 82-630, 1983. 1 Sheet map, 11 Fig, 4 Tab, 8 Ref.

Descriptors: *Lakes, Aquifers, *Sinkholes, Rainfall, Evaporation, Groundwater, *Lake levels, Water quality, Basin, Control structures, *Florida, Southwest Florida Water Management district, Unconsolidated sand, Clay, Peace River basin, *Maps, Hamilton Lakes.

The Hamilton lakes, headwaters of the eastern arm of the Peace River drainage system, consist of Lake Hamilton, Middle Lake Hamilton, and Little Lake Hamilton. The lakes, which are connected by canals that tend to equalize their levels, probably occupy coalesced sinkhole depressions. The drainage basin of Lake Hamilton contains several water-control structures which can alter the effective size of the area contributing water to the Hamilton lakes according to their gate settings. The chemical and biological conditions in the Hamilton lakes are such that the lakes are not sufficiently enriched to cause problems with excessive weed growth or algae blooms. (USGS)
W84-00905

WATER QUALITY OF THE TIDAL RIVER AND ESTUARY; HYDROLOGIC DATA REPORT, 1981 WATER YEAR WITH A SECTION ON CHLOROPHYLL-A: COLLECTION AND ANALYSIS,
Geological Survey, Reston, VA. Water Resources Div.
S. F. Blanchard, R. H. Coupe, Jr., and J. C. Woodward.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $39.50 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-575, 1982. 298 p, 5 Fig, 3 Tab, 26 Ref, 3 Append.

Descriptors: *Hydrologic data, *Tidal Potomac River, *Water quality, *Potomac estuary study, *Chlorophyll-a analysis.

This report contains data on the physical and chemical properties measured in the Tidal Potomac River and Estuary during the 1981 water year. Data were collected at least weekly at five stations, and periodically at 15 stations and at two other stations near the mouth of the Potomac River in Chesapeake Bay. Each of the five stations represent a cross section at which the transport of selected dissolved and suspended materials can be computed. The remaining 17 stations are locations at which data were collected for special studies of selected phenomena, such as salt water migration and dissolved oxygen dynamics. Samples were routinely analyzed for chlorophyll-a, nitrogen, pheophytin, phosphorus, silica and suspended sediment. Additional samples were analyzed for adenosine triphosphate, algal growth potential, alkalinity, calcium, chloride, dissolved-solids residue, fluoride, iron, manganese, magnesium, nitrifying bacteria, organic carbon, potassium, seston, sodium, and sulfate. In addition, in-situ measurements of dissolved oxygen, specific conductance, pH, temperature, solar radiation, and secchi disk transparency were made. (USGS)
W84-00906

WATER QUALITY MONITORING - RIVERS AND STREAMS, 1982.
Indiana State Board of Health, Indianapolis. Div. of Water Pollution Control.
Report, 1982. 138 p, 6 Tab.

Descriptors: *Water sampling, *Water analysis, *Water measurement, Water pollution, *Water pollution control, *Water pollution effects, Water quality management, Water quality, Biological samples, Chemical analysis, Chemical composition, State jurisdiction, Municipal water, *Indiana.

A program in Indiana to provide basic information on pollution trends and to provide water quality data for the state's surface water users has been described in annual water quality reports. This report, the 25th, emphasizes the importance of surface water via the fact that two-thirds of the water usage in Indiana in 1980 was obtained from surface supplies. While 49 sites were sampled in 1952, 92 stations are included in the current program. Physical, chemical, and bacteriological analyses are made on samples collected from all 92 stations; plankton analyses from 18; and radiological analyses from 23. The forty-five methods of analyses used represent the minimum of bacteriological, chemical, and radiological analysis which would justify the collection program. The monitoring program is intended to indicate, when possible, the sources of pollution abatement programs, and to collect background data on certain types of waste, such as chlorides and radioactive materials. The monitoring stations are selected on the basis of having waters used for municipal, industrial, agricultural and recreational purposes; if they are near known or suspected sources of pollution; and when they are near state boundaries to determine the quality of water entering or leaving the state. Routine samples include 2,000 milliliters for chemical analysis and about 100 milliliters in a sterile bottle for bacteriological analysis. This year no flow data are included. (Garrison-Omniplan)
W84-00910

WATER-LEVEL MAPS OF THE ALLUVIAL AQUIFER, NORTHWESTERN MISSISSIPPI SEPTEMBER 1981,
Geological Survey, Jackson, MS. Water Resources Div.
D. Darden.
USGS Open-File Report 82-574, 1982. 1 Sheet map, 1 Fig, 6 Ref.

Descriptors: *Mississippi, *Groundwater, *Aquifers, *Water levels, Mississippi River valley alluvial aquifer, Quarternary aquifers, *Maps, Water wells.

Water levels were measured in 427 wells in the Mississippi River valley alluvial aquifer in northwestern Mississippi during the period September 15-28, 1981. Water levels in the alluvial sands and gravel were generally lower than water levels in September 1980 and larger depressions in the surface of the ground-water body were detected in the Sunflower-Leflore County area and in Humphreys County. These depressions are attributed to heavy pumping for irrigation and to less-than normal rainfall. Other smaller depressions are attributed to local heavy pumping. (USGS)
W84-00921

APPROXIMATE ALTITUDE OF WATER LEVELS IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS IN THE HOUSTON AREA, TEXAS, SPRING 1982,
Geological Survey, Austin, TX.
C. E. Ranzau, Jr., and J. L. Strause.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $1.00 in paper copy, $1.00 in microfiche. USGS Open-File Report 82-559, June 1982. 2 Sheet maps, 2 Fig, 1 Ref.

Descriptors: *Groundwater, Water levels, *Water-level fluctuations, Aquifers, *Maps, Harris County, Galveston County, *Texas.

These two maps show water levels in wells in the Houston, Texas area in (1) the Chicot aquifer, spring 1982 and (2) the Evangeline aquifer, spring 1982. Both the Chicot and Evangeline aquifers are composed of several sand layers with different potentiometric surfaces. These maps, however, show approximations of single potentiometric surfaces that represent composite hydraulic heads. (USGS)
W84-00922

MONTHLY LOW-FLOW CHARACTERISTICS OF GEORGIA STREAMS,
Geological Survey, Doraville, GA. Water Resources Div.
R. F. Carter, and J. D. Lewis.
USGS Open-File Report 82-560, 1982. 81 p, 6 Fig, 1 Tab, 12 Ref.

Descriptors: *Flow variability, *Low flow, *Monthly frequency, Time sampling, *Streamflow, *Stream gages, *Georgia.

Statistics of monthly minimum flows are presented for 129 streamflow stations for each month of the year. Flow statistics provided are the log-Pearson Type III distribution. The probable magnitude of average standard errors due to time-sampling bias is tabulated. The average standard errors were found to be similar over a wide area comprising approximately the northern two-thirds of the State. In this area, the average standard error of estimate for a low-flow statistic with a recurrence interval of 20 years and estimated on the basis of 10 years of record is about 17%. In the southern third of the State, the average standard errors were found to lie in a narrow range, but were significantly greater than in the north. In the southern area, the average standard error of estimate for a low flow statistic with a recurrence interval of 20 years and estimated on the basis of 10 years of record is about 40%. (USGS)
W84-00923

GROUND WATER AND GEOLOGY OF MARQUETTE COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-00925

WATER QUALITY OF COAL DEPOSITS AND ABANDONED MINES, SAGINAW COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
A. H. Handy.
USGS Open-File Report 82-511, 1982. 35 p, 7 Fig, 5 Tab, 12 Ref.

Descriptors: Water quality, *Groundwater, Streams, Wetlands, Trace elements, *Coal mines,

Mining, Glacial drift, Saginaw formation, St. Charles, Saginaw County, *Michigan.

Coal was last mined in Saginaw County, Michigan in 1950. Water from abandoned mines and from undisturbed coal-bearing beds in the Saginaw Formation is highly mineralized and contains high concentrations of iron. Compared to streams in the area, the water contains higher concentrations of at least 15 constituents including boron, phenol, lithium, strontium, and manganese. Water from abandoned mines and coal-bearing beds is a poor source of water for domestic, public, or agricultural uses. Large amounts of this highly mineralized ground water reaching local streams would have a deleterious effect on surface-water quality. (USGS)
W84-00926

DATA FOR GROUND-WATER TEST HOLE NEAR ZAMORA, CENTRAL VALLEY AQUIFER PROJECT, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
J. J. French, R. W. Page, and G. L. Bertoldi.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $12.25 in paper copy, $4.00 in microfiche. USGS Open-File Report 82-510, July, 1982. 72 p, 13 Tab, 16 Fig, 22 Ref.

Descriptors: Test holes, Electrical well logging, Radioactive well logging, Diatoms, Clay minerals, Piezometers, *Water level fluctuations, *Water quality, *Groundwater, Sacramento Valley, *California, Yolo County, Central Valley Aquifer Project.

Preliminary data are presented for the first of seven test holes drilled as a part of the Central Valley Aquifer Project which is part of the National Regional Aquifer Systems Analysis Program. The test hole was drilled in the SW 1/4 SE 1/4 sec. 34, T. 12 N., R. 1 E., Yolo County, California, about 3 miles northeast of the town of Zamora. Drilled to a depth of 2,500 feet below land surface, the hole is cased to a depth of 190 feet and equipped with three piezometer tubes to depths of 947, 1,401, and 2,125 feet. A 5-foot well screen is at the bottom of each piezometer. Eighteen cores and 68 sidewall cores were recovered. Laboratory tests were made for mineralogy, hydraulic conductivity, porosity, consolidation, grain-size distribution, Atterberg limits, X-ray diffraction, diatom identification, thermal conductivity, and chemical analysis of water. Geophysical and thermal gradient logs were made. The hole is sampled periodically for chemical analysis and measured for water level in the three tapped zones. This report presents methods used to obtain field samples, laboratory procedures, and the data obtained. (USGS)
W84-00927

WATER USE IN WISCONSIN, 1979,
Geological Survey, Madison, WI. Water Resources Div.
C. L. Lawrence, and R. R. Ellefson.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $13.25 in paper copy, $3.50 in microfiche. USGS Water-Resources Investigations Open File Report 82-444, July 1982, 98 p, 1 Fig, 5 Tab, 9 Ref.

Descriptors: *Water use, *Wisconsin, *Groundwater pumpage, *Municipal water, Domestic water, Industrial water, Irrigation water, Withdrawal, Wells, Electric powerplants, Water users, Water supply.

This report summarizes the uses of water in Wisconsin during 1979. It considers all uses except those not involving significant position movement such as recreation. The greatest single use of water, an instream use, was for hydroelectric power production. About 26 trillion gallons, or 93% was used for this purpose. Of the other 7% where water is pumped to a different location 81% (6% of all water use) was cooling water for thermoelectric powerplants. Withdrawals of surface water by public and private systems are for residential, industrial, commercial, irrigation, and stock uses. (USGS)
W84-00928

HYDROLOGIC DATA FROM MONITORING OF SALINE-WATER INTRUSION IN THE CAPE CORAL AREA, LEE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. J. Fitzpatrick.
Available from the OFSS, USGS, Lakewood CO 80225, Price: $6.75 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-772, 48 p, 19 Fig, 7 Tab, 2 Ref.

Descriptors: Aquifers, Water levels, Water quality, Observation wells, Lithology, *Saline water intrusion, *Florida, Lee County, Cape Coral, *Hydrologic data.

As a result of declining water levels and saltwater intrusion in the Cape Coral area, the U.S. Geological Survey, in cooperation with the City of Cape Coral, established a monitor well network in Cape Coral and adjacent areas in 1978. The network was designed to monitor water levels and water quality, to collect background data from water-bearing zones in the upper and lower parts of the Hawthorn Formation, the upper part of the Tampa Formation, and the surficial aquifer. A network of 34 wells tapping the artesian freshwater-bearing aquifer in the upper part of the Hawthorn Formation was established, and water-quality samples were collected and analyzed semiannually from 1978-80. Water levels in selected wells were monitored continuously or measured monthly, bimonthly, or semiannually for general trends. Thirty-six wells tapping the surficial and six wells tapping the artesian aquifer in the lower part of the Hawthorn Formation were constructed. Selected wells in these aquifers have also been monitored for water levels continuously, or at monthly, bimonthly, or semiannual intervals. Water-quality data were collected from selected wells for background information. Lithologic logs were prepared for 18 wells penetrating one or more of the three aquifers. (USGS)
W84-00935

FIELD DATA DESCRIBING THE MOVEMENT AND STORAGE OF SEDIMENT IN THE EAST FORK RIVER, WYOMING, PART IV. BED ELEVATIONS, 1980,
Geological Survey, Denver, CO. Water Resources Div.
R. H. Meade, R. M. Myrick, and W. W. Emmett.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $26.25 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-360, 1982. 197 p, 8 Fig, 47 Tab, 13 Ref.

Descriptors: *Alluvial channels, Aggradation, *Degradation, *Sediment transport, *Wyoming, East Fork River, Upper Green River basin.

Bed elevations were measured every 1 to 5 days during 10 consecutive weeks which included the peak snowmelt runoff, at 43 cross sections in a 1.83-kilometer reach of the East Fork River, Wyoming. Considerable scour and fill were recorded at many of the cross sections. (USGS)
W84-00936

FIELD DATA DESCRIBING THE MOVEMENT AND STORAGE OF SEDIMENT IN THE EAST FORK RIVER, WYOMING: PART III. RIVER HYDRAULICS AND SEDIMENT TRANSPORT, 1980,
Geological Survey, Denver, CO. Water Resources Div.
W. W. Emmett, R. M. Myrick, and R. H. Meade.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $38.50 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-359, 1982. 289 p, 9 Fig, 223 Tab, 23 Ref.

Descriptors: *Bedload, Bedload samplers, Fluvial sediment, *Geomorphology, Particle size, Rivers, Sediments, Sedimentation, *Sediment load, *Sediment transport, *Wyoming, East Fork River, Helley-Smith bedload sampler.

Frequent measurements of river stage, water discharge, sediment-transport rate and particle-size gradation, and river slope were made at 44 cross sections along a 1.83-kilometer reach of East Fork River, Wyoming, during the spring 1980 snowmelt runoff. Data are tabulated and explanatory text facilitates its use for description of river hydraulics and sediment transport. (USGS)
W84-00937

WATER-QUALITY DATA FOR THE AMERICAN RIVER BASIN, CALIFORNIA, FEBRUARY-OCTOBER 1979,
Geological Survey, Sacramento, CA. Water Resources Div.
J. M. Shay.
Available from the USGS, OFSS, Lakewood, CO 80225, Price: $7.75 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-363, March 1982. 56 p, 1 Fig, 9 Tab, 8 Ref.

Descriptors: Biological properties, Chemical properties, Physical properties, *Water quality data, *Data collection, *California, American River basin, Folsom Lake.

Data were collected in the American River basin from February to October 1979 for use in assessing the water quality in the basin and developing land-use/water-quality relations. The basin covers 2,163 square miles of the western slope of the central Sierra Nevada. Basin headwaters are located primarily between Donner Summit and Echo Summit. Water-quality data were collected at 14 stream sites and at 3 sites on Folsom Lake and include selected measurements and analyses for physical, chemical, and biological properties and constituents. (USGS)
W84-00938

ANNUAL SUMMARY OF GROUND-WATER CONDITIONS IN ARIZONA, SPRING 1980 TO SPRING 1981.
Geological Survey, Tucson, AZ. Water Resources Div.
USGS Water-Resources Investigations Open-File Report 82-368, March 1982. 2 Sheet Maps, 5 Fig, 3 Tab, 19 Ref.

Descriptors: Water levels, *Water-level fluctuations, *Pumpage, Irrigation, *Groundwater, *Maps, *Withdrawal, *Arizona, Basin and Range lowlands province, Central highlands province, Plateau uplands province.

The withdrawal of ground water was about 4.6 million acre-feet in Arizona in 1980, which is about 600,000 acre-feet more than the amount withdrawn in 1979. Although this amount is a substantial increase from that withdrawn in 1978 and 1979, it is less than the amount of ground water used annually since the mid-1960's and nearly equivalent to the amount used during the 1950's. Most of the increase in 1980 was in the amount of ground water used for irrigation in the Basin and Range lowlands province. Through 1980, nearly 184 million acre-feet of ground water had been withdrawn from the ground-water reservoirs in Arizona. The report contains two small-scale maps that show ground-water pumpage by areas and the status of the ground-water inventory in the State. The main map, which is at a scale of 1:500,000, shows potential well production, depth to water in selected wells in spring 1981, and change in water level in selected wells from 1976 and 1981. A brief text summarizes the current ground-water conditions in the State. (USGS)
W84-00941

HYDROLOGIC MONITORING IN THE AREA OF THE PROPOSED YAZOO RIVER NAVIGATION PROJECT, WEST CENTRAL MISSISSIPPI, 1978-80,
Geological Survey, Jackson, MS. Water Resources Div.
D. Darden.
USGS Open-File Report 82-369, 1982. 71 p, 1 Fig, 4 Ref.

Descriptors: *Mississippi, *Environmental effects, *Inland waterways, *Groundwater levels, Aquifers, Hydrographs, *Yazoo navigation study,

Yazoo River, Mississippi River Valley alluvial aquifer, Aquifers.

Hydrologic data on ground-water levels collected from the area of the proposed Yazoo River Navigation Project for the years 1978-80 are presented without interpretation. These data were obtained as part of a hydrologic study to understand the hydrologic effects of construction and operation of a waterway on the Yazoo River. The data were collected in cooperation with the Vicksburg District, Corps of Engineers, U.S. Army. During the data collection period, water-level measurements were made on about a monthly schedule in 62 observation wells in the network. Three of the wells were equipped with continuous water-level recorders. (USGS)
W84-00942

INDEX OF HYDROLOGIC DATA FOR SELECTED SITES IN BROWARD COUNTY, FLORIDA, 1939-80,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. S. Sonenshein, J. E. Fish, C. R. Causaras, and D. M. Poore.
USGS, OFSS, Lakewood, CO 80225, Price: $15.00 in paper copy, $5.50 in microfiche. USGS Open-File Report 82-920, 1982. 39 p, 4 Sheet maps, 6 Fig, 5 Tab, 14 Ref.

Descriptors: Hydrology, Geology, *Water quality, *Aquifers, *Florida, Broward County, Surficial aquifers, Biscayne aquifer, *Maps.

A comprehensive assessment of the surficial aquifers, of southeast Florida, including the Biscayne aquifer, was begun in 1979 by the U.S. Geological Survey, in cooperation with the South Florida Water Management District. In the initial phase of the study, an inventory was made of existing data available in the files of the U.S. Geological Survey and other public agencies of Dade, Broward, and Palm Beach counties. This report indexes through tables and maps, the ground-water quality, ground-water level, surface-water stage, and geologic data bases for Broward County. (USGS)
W84-00943

RECORDS OF SELECTED WELLS AND LITHOLOGIC LOGS OF TEST HOLES, HENDRY COUNTY AND ADJACENT AREAS, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. E. Fish, C. R. Causaras, and T. H. O'Donnell.
USGS Open-File Report 83-134, 1983. 116 p, 5 Fig, 2 Tab, 3 Ref.

Descriptors: *Well data, *Lithologic logs, Water quality, *Florida, Hendry County, Surficial aquifer, Deep artesian aquifers.

To provide water-resource information for Hendry County, Florida, geologic test holes were drilled in the surficial aquifer, and an extensive inventory was compiled of wells in the surficial aquifer and deep artesian aquifers. This report provides: (1) records for 788 selected wells and test holes including location, construction, water use, water level, chloride concentration, specific conductance, temperature, yield, hydrogen sulfide, and iron-staining problems; and (2) lithologic logs for 26 test holes ranging in depth from 90 to 650 feet. A few inventoried wells and two test holes are in adjacent parts of Collier or Glades Counties. (USGS)
W84-00945

HYDROLOGIC DATA FOR THE PELICAN RIVER SANDS AQUIFER, WESTERN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
R. T. Miller.
USGS Open-File Report 80-695, 1981. 86 p, 2 Fig, 4 Tab, 2 Ref.

Descriptors: *Groundwater, *Observation wells, *Water levels, *Water quality, Aquifer, Drawdown, Data collections, Pump testing, *Basic data, *Pelican River, *Minnesota.

Hydrogeologic data for the Pelican River sands aquifer have been compiled in this report for use by the public and by State and local officials in making water development and management decisions. This report will supplement an interpretive report on the hydrogeology of the Pelican River sands aquifer that is scheduled for publication in 1981. The data which were collected in 1965, 1972, and 1978-79, include results of chemical analyses of water from selected wells, water-level measurements in wells, logs of test holes and observation wells, and results of aquifer tests. (USGS)
W84-00947

DRAINAGE AREAS OF THE KANAWHA RIVER BASIN,
Geological Survey, Charleston, WV. Water Resources Div.
M. V. Mathes, D. D. Payne, Jr., and R. A. Shultz.
USGS Open-File Report 82-351, 1982. 222 p, 1 Fig, 2 Tab, 1 Ref.

Descriptors: *Drainage area, *River miles, *Data collection, *West Virginia, Kanawha River basin, *Data collection.

Drainage areas for 1,493 drainage area divisions for the Kanawha River basin, West Virginia, are listed in the report. Also tabulated for each site are river miles, plus location identifiers: County, latitude and longitude, and the West Virginia District map number. (USGS)
W84-00948

POTENTIOMETRIC-SURFACE MAP OF WATER IN THE EAGLE SANDSTONE AND EQUIVALENT UNITS IN THE NORTHERN GREAT PLAINS AREA OF MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
G. W. Levings.
USGS Open-File Report 82-565, 1982. 1 Sheet map, 1 Fig, 7 Ref.

Descriptors: *Groundwater, *Potentiometric level, *Aquifers, Eagle Sandstone, Virgelle Sandstone, Telegraph Creek Formation, *Montana, *Maps.

The potentiometric surface of water in the Upper Cretaceous Eagle Sandstone and equivalent units (Virgelle Sandstone and Telegraph Creek Formation) is shown on a base map at a scale of 1:1,000,000. The map is one of a series of maps produced as part of a regional study of aquifers of Cenozoic and Mesozoic age in the northern Great plains of Montana. The contour interval is 200 feet. The map shows that the directions of regional ground-water movement is from west to east except in the extreme northwestern corner where the movement is from east to west. Water is discharged from the Eagle Sandstone to the Missouri River south of the Bearpaw Mountains. In the area north of the Bearpaw Mountains, depressurization from gas production may account for the decline in the potentiometric surface. The average discharge from 115 wells is about 23 gallons per minute and the specific capacity of 85 wells averages 1.4 gallons per minute per foot of drawdown. (USGS)
W84-00949

GROUND-WATER LEVELS IN WYOMING, 1971 THROUGH PART OF 1980,
Geological Survey, Cheyenne, WY. Water Resources Div.
J. O. Ragsdale.
USGS Open-File Report 82-859, 1982. 200 p, 171 Fig, 21 Tab, 7 Ref.

Descriptors: *Groundwater, Hydrographs, *Observations wells, Water-level recorders, *Wyoming, Cheyenne, Data collections.

Ground-water levels are measured periodically in a network of about 280 observation wells in Wyoming, mostly in areas where ground water is used in large quantities for irrigation or municipal purposes. The program is conducted by the U.S. Geological Survey in cooperation with the Wyoming State Engineer and the city of Cheyenne. This report contains maps showing the locations of selected wells, tables listing well histories and highest and lowest water levels for the period of record, and hydrographs for most of the wells. (USGS)
W84-00950

DATA ON SUBSURFACE STORAGE OF LIQUID WASTE NEAR PENSACOLA, FLORIDA, 1963-1980,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. W. Hull, and J. B. Martin.
USGS, OFSS, Fed. Cntr., Lakewood, CO. 80225, Price: $24.00 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-689, 1982. 179 p, 10 Fig, 31 Tab, 40 Ref.

Descriptors: *Injection wells, *Underground waste disposal, Monitoring, Underground storage, Data collections, *Florida, *On-site monitoring wells, Facilities monitoring.

Since 1963, when industrial waste was first injected into the subsurface in northwest Florida, considerable data have been collected relating to the geochemistry of subsurface waste storage. This report presents hydrogeologic data on two subsurface waste storage systems near Pensacola, Fla., which inject liquid industrial waste through deep wells into a saline aquifer. Injection sites are described giving a history of well construction, injection, and testing; geologic data from cores and grab samples; hydrographs of injection rates, volume, pressure, and water levels; and chemical and physical data from water-quality samples collected from injection and monitor wells. (USGS)
W84-00951

WATER RESOURCES OF THE GUYANDOTTE RIVER BASIN, WEST VIRGINIA,
Geological Survey, Charleston, WV. Water Resources Div.
J. S. Bader, J. L. Chisholm, R. L. Bragg, and S. C. Downs.
West Virginia Geological and Economic Survey, Morgantown, Basic Data Report No 7, 1977. 550 p, 58 Fig, 13 Tab, 632 Ref.

Descriptors: *Flow characteristics, *Surface runoff, Geology, Surface-ground water relationships, *Chemical analyses, *Aquatic microbiology, *Waste disposal, Streamflow, Water quality, Water-pollution sources, Conductivity, *West Virginia, *Guyandotte River basin, 7-day, 10-year flow, *Well yield, Geologic structure, Coal-mining activities.

The 1975-78 water-resources study of the Guyandotte River basin, West Virginia is part of the continuing investigation of the water resources of the State's basins by the U.S. Geological Survey. The study, conducted in cooperation with the West Virginia Geological and Economic Survey and the West Virginia Department of Natural Resources, Division of Water Resources, includes an inventory of available water, water quality, and occurrence. Surface-water-runoff characteristics such as average runoff per year, 7-day 10-year flow, mean-annual streamflow, maximum flood discharge, and time of travel are described. An interpretive description of surface water quality, basin on chemical, biological, microbiological, and physical data collected at some 140 stream sites, is presented. Both the quantity and quality of ground water are related to control factors. The most important factors affecting well yields are shown to be geologic and topographic structure. Potential and existing water-quality problems, as related to ground water and surface water, are pointed out. (USGS)
W84-00952

FLOODS OF OCTOBER 1977 IN SOUTHERN ARIZONA AND MARCH 1978 IN CENTRAL ARIZONA,

Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 2E.
W84-00953

RECONNAISSANCE OF GROUND-WATER QUALITY, EASTERN SNAKE RIVER BASIN, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-00974

DATA FROM THE SURFACE-WATER HYDROLOGIC INVESTIGATIONS OF THE HAY CREEK STUDY AREA, MONTANA, AND THE WEST BRANCH ANTELOPE CREEK STUDY AREA, NORTH DAKOTA, OCTOBER 1976 THROUGH APRIL 1982,
Geological Survey, Bismarck, ND. Water Resources Div.
G. Douglas, S. W. Norbeck, and K. L. Boespflug.
USGS Open-File Report 83-136, February 1983. 273 p, 6 Fig, 9 Tab, 21 Ref.

Descriptors: *Hydrologic data, *Climatic data, *Montana, *North Dakota, Fort Union Coal Region, Hay Creek, West Branch Antelope Creek.

Data are provided for the Hay Creek study area near Wibaux, Montana, and the West Branch Antelope Creek study area near Beulah, North Dakota. The report contains data on the following: Air temperature, relative humidity, wind direction, wind run, solar radiation, precipitation, soil temperature, snowpack temperature, snowpack density and moisture content, streamflow, water quality, soil moisture, land use, and basin characteristics. Detailed descriptions of the location of the data-collection sites, instrumentation, and methods used to collect data are included. (USGS)
W84-00976

WATER RESOURCES OF BORREGO VALLEY AND VICINITY, CALIFORNIA, PHASE 1--DEFINITION OF GEOLOGIC AND HYDROLOGIC CHARACTERISTICS OF BASIN,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
W. R. Moyle, Jr.
USGS Open-File Report 82-855, November 1982. 39 p, 21 Fig, 8 Tab, 44 Ref.

Descriptors: Chemical analysis, Streamflow, Precipitation, Specific yield, Hydraulic conductivity, Transmissivity, Gravity, Land use, Hydrologic model, Borrego Valley, Clark Lake Valley, Borrego, Borrego Springs, Santa Rosa Mountains, Borrego Mountain, Anza-Borrego State Park, San Diego County, *California, *Withdrawal, *Groundwater depletion, *Groundwater storage.

This report is phase 1 of a 3-phase study and includes information needed to build a digital hydrologic model of Borrego Valley. It includes sources and amounts of recharge water to the basin, areas of water withdrawal, total ground water in storage at steady-state conditions (1945), net ground-water depletion, grid network used to determine storage and depletion, total depth of alluvial fill, transmissivity, hydraulic conductivity and specific yield of aquifers, thickness of individual aquifers, and chemical quality of water. (USGS)
W84-00980

JANUARY 1982 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
M. E. Pabst.
Available from the USGS, OFSS, Fed. Center, Lakewood, CO 80225, Price: $21.50 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-649, 1982. 167 p, 2 Fig 1 Tab, 13 Ref.

Descriptors: *Groundwater, *Water-level changes, *Hydrologic data, *Kansas, Base-line studies.

Water-level measurements were made, mostly in January 1982, in about 1,530 wells in western and south-central Kansas. The measurements were made in mid-winter when pumping was minimal and water levels had recovered, for the most part, from the effects of pumping during the previous irrigation season. Annual hydrologic data are provided for relating water-level changes from a 'base-reference year' (predevelopment year), a year of abnormally high rainfall and minimum pumpage (1966 or 1974), and each of seven consecutive years of measurement (1976-82), the 'base-reference year' is designated as 1940 for the southwestern area, 1944 for the south-central area, and 1950 for the northwestern and west-central areas. Water levels for the 'base-reference year' are established by measurements made during that year and by interpretation of maps showing water-level altitudes. Data also are provided for relating the average annual water-level changes, saturated thicknesses of the deposits, and percentage changes in saturated thicknesses. (USGS)
W84-00981

QUALITY OF RUNOFF FROM SMALL WATERSHEDS IN THE TWIN CITIES METROPOLITAN AREA, MINNESOTA--HYDROLOGIC DATA FOR 1980,
Geological Survey, St. Paul, MN. Water Resources Div.
G. A. Payne, M. A. Ayers, and R. G. Brown.
Available from the USGS, OFSS, Lakewood CO 80225, Price: $37.75 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-504, 1982. 289 p, 7 Fig, 17 Ref.

Descriptors: *Storm runoff, *Urban runoff, *Agricultural runoff, *Small watersheds, Urban hydrology, Land use, Storm water, Storm drains, Precipitation(Atmospheric), Antecedent precipitation, Rainfall intensity, Rain gages, Water quality, Twin Cities metropolitan area, *Minnesota.

An investigation of nonpoint-source runoff from small watersheds in the Twin Cities metropolitan area was conducted to define relationships between land use, watershed characteristics, and the quantity, quality, and timing of runoff. Six rural and four urban watersheds ranging in size from 1.22 to 82.9 square miles were studied. Discharge and water-quality data were collected at 19 sites during 1980. Recording instruments and automatic samplers provided continuous discharge records at 17 sites, continuous rainfall records and automatic collection of samples at 12 sites, and wetfall/dryfall precipitation samples at six sites. Sampling was intensified during periods of increased runoff resulting from snowmelt and rainstorms. Primary emphasis was placed on analysis of samples for suspended solids, nutrients, and chemical oxygen demand. Samples were also analyzed for chloride, metals, bacteria, and pesticides. The data are documented in tables containing basin characteristics and land use, daily and unit values for discharge and rainfall, rainfall characteristics, water-quality data for runoff and precipitation, results of laboratory settling test, results of quality assurance tests, daily loads, and storm loads. (USGS)
W84-00982

ATLAS OF ELEVEN SELECTED AQUIFERS IN NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. M. Waller, and A. J. Finch.
USGS Open-File Report 82-553, 1982. 255 p, 103 Fig, 11 Tab, 200 Ref.

Descriptors: *Groundwater, Unconsolidated aquifers, Groundwater movement, Glacial drift, Infiltration, Land use, Well yield, Surface-groundwater relations, Alluvium, Water use, *New York, *Atlas, *Aquifers.

Water from 11 aquifer systems in New York, excluding Long Island, is used by 2.8 million people. Ten are in areas hydraulically connected with the master stream and have a shallow water table, the 11th is a buried valley system on the Lake Ontario Plain. In all systems, till, lake silt and clay, and bedrock knobs are interspersed within sand and gravel. Confining conditions occur locally in all systems and are extensive in some. Each area is partly urbanized, contains industry, and has an extensive transportation network, all of which may be sources of contamination. Well yields for public and industrial supply are commonly several hundred gallons per minute. More than 90 maps depict surficial geology, soil-zone permeability, aquifer dimensions and potential, water levels, and land use; tables of ground-water use, population served, and a summary of contamination potential are also given. Major concern in all areas is the potential for contamination and, in a few areas, adequacy of supply. The areas described are Schenectady, Endicott-Johnson City, Ramapo and Mahwah Rivers, Irondequoit Creek, Jamestown, Elmira-Horseheads-Big Flats, Cortland, Homer-Preble, Sprout and Fishkill Creeks, Fulton, and south Fallsburg-Woodbourne. (USGS)
W84-00983

GEOHYDROLOGY OF THE FLORIDAN AQUIFER IN THE WITHLACOOCHEE RIVER BASIN OF THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Geological Survey, Orlando, FL. Water Resources Div.
W. Anderson, and C. P. Laughlin.
USGS Water-Resources Investigations Open-File Report 82-331, 1982. 4 Sheet maps, 17 Fig, 5 Tab, 24 Ref.

Descriptors: *Aquifers, Confining beds, Discharge, *Groundwater, Potentiometric surface, Water quality, Quality, Basin, *Florida, Limestones, *Maps, Unconsolidated deposits, Withlacoochee River.

The Withlacoochee River basin of the Southwest Florida Water Management District occupies about 2,030 square miles in west-central Florida. The basin is underlain by limestones that include the Floridan aquifer, the principal source of water in the basin. In some parts of the basin, the potentiometric surface of the Floridan is below the top of the aquifer. The Floridan is considered unconfined and under water-table conditions throughout these parts even though locally, it is overlain by unconsolidated deposits that may support one or more perched aquifers. The Floridan also is considered unconfined in those parts overlain by permeable deposits, even where the potentiometric surface is above the top of the aquifer. The Floridan is considered confined in those parts of the basin where it is overlain by impermeable deposits and its potentiometric surface is above its top. Recharge to the Floridan in the basin is greatest in those parts that are internally drained and least, in those parts where its permeability is low and surface runoff occurs. The Floridan discharges in the basin at springs and seeps in and near the Withlacoochee River. Water quality in the Floridan is generally excellent. However, color, iron, chloride, and dissolved solids exceed standards in some parts of the basin. (USGS)
W84-00984

GROUND-WATER DATA FOR GEORGIA, 1981,
Geological Survey, Doraville, GA. Water Resources Div.
S. E. Matthews, W. G. Hester, and K. W. McFadden.
USGS Open-File Report 82-902, 1982. 110 p, 55 Fig, 26 Ref.

Descriptors: *Groundwater, *Water levels, Aquifers, *Georgia, Water quality, *Water level fluctuations, *Groundwater levels, Groundwater quality.

More than 2,000 water-level measurements made in Georgia in 1981 provide the basic data for this report. Daily mean water-level fluctuations and trends are shown in hydrographs for the previous year (1980) and fluctuations of the monthly mean water levels are shown for selected years in some observation wells in Georgia. Water-quality samples are collected periodically throughout Georgia and analyzed as part of areal and regional groundwater studies. Along the coast, chloride concentrations have remained stable around Savannah, but

invasion of brackish water into the aquifer at Brunswick has increased the chloride concentration. Mean annual water levels throughout Georgia ranged from 3.42 feet higher to 12.68 feet lower in 1981 than in 1980, and in some areas were the lowest on record. (USGS)
W84-00986

APPRAISAL OF WATER FROM THE PELICAN RIVER SAND-PLAIN AQUIFER, WEST-CENTRAL MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-00988

MAGNITUDE AND FREQUENCY OF FLOODING ON SMALL URBAN WATERSHEDS IN THE TAMPA BAY AREA, WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2A.
W84-00994

PUMPAGE OF WATER IN LOUISIANA, 1980,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 6D.
W84-00997

GEOHYDROLOGY OF THE HIGH PLAINS AQUIFER SYSTEM IN NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
R. A. Pettijohn, and H. H. Chen.
USGS Water Resources Investigations Open File Report 82-502, May 1983. 4 Sheet Maps, 16 Ref.

Descriptors: Great Plains, *Nebraska, *Groundwater, *Aquifer, *Maps, Irrigation, Hydrogeologic data, Tertiary period, Quaternary period, *High Plains aquifer system, Saturated thickness, *Water-level contours, Depth to water, *Water-level declines, Water-level rises, Base of aquifer.

Geohydrologic data used to evaluate the groundwater potential of the High Plains aquifer system in Nebraska are presented on maps showing the geology and configuration of the base of the aquifer system, the potentiometric surface of the aquifer system prior to 1950 and in 1980, and the depth to water and saturated thickness of the aquifer system in 1980. The High Plains aquifer system underlies 177,000 square miles in parts of eight states including 64,770 square miles in Nebraska. It consists of the Ogallala Group and other Tertiary and Quaternary deposits that are saturated and hydraulically connected to the Ogallala. The High Plains aquifer system in Nebraska is underlain primarily by the White River Formation and undifferentiated rock of Cretaceous age. Water moves easterly through the system at gradients from 2 to 85 feet per mile. Tabular data indicate that the saturated thickness of the aquifer exceeds 200 feet in 66% of the aquifer area; this same area contains 91% of the 4.9 billion acre-feet of water in storage. Water levels declined in 15% of the aquifer area and rose in 4% from predevelopment to 1980, due to ground-water and/or surface-water development for irrigation. (USGS)
W84-01002

SEDIMENT AND STREAM-VELOCITY DATA FOR THE SACRAMENTO RIVER NEAR HOOD, CALIFORNIA, MAY 1978 TO SEPTEMBER 1981,
Geological Survey, Sacramento, CA. Water Resources Div.
J. G. Harmon.
USGS Open-File Report 83-135, April 1983. 80 p, 3 Fig, 1 Tab, 4 Ref.

Descriptors: Aqueduct, Canal, Sand, Sediment concentration, *Sediment distribution, Settling basins, Streambed, Streamflow, Vertical distribution, *California, *Stream velocity data, Data collections, Sacramento River.

Sediment and stream velocity data from the Sacramento River are required to determine the size requirements of a settling basin for the intake area of the proposed Peripheral Canal near Hood, California. Sediment and stream-velocity data were gathered from May 1978 to September 1981 over several magnitudes of streamflow at fo · cross sections near Hood. This report, prepared in cooperation with the California Department of Water Resources, contains data that show the vertical distribution and size of sediment, and the magnitude and direction of stream velocity measured at 25 points in each of the four cross sections on several occasions. (USGS)
W84-01003

PRINCIPAL AQUIFERS IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. Franks, J. Cushman-Roisin, J. A. Miller, C. B. Bentley, and H. Klein.
USGS Water-Resources Investigations Open-File Report 82-255, 1982. 4 Sheet Maps, 15 Fig, 7 Tab, 160 Ref.

Descriptors: *Groundwater, *Aquifers, Geohydrology, Unconsolidated aquifers, Coastal aquifers, Water aquifers, Water supply, Groundwater availability, *Maps, *Florida.

Ground water, readily available throughout most of Florida, is the primary source of drinking water for about 90% of the State's population. The State has several ground-water reservoirs that yield large quantities of water to wells, and also has some of the world's largest springs. Virtually all of Florida is underlain by underground sources of drinking water capable of yielding at least small quantities of water to wells. The principal source of ground water is the Floridan aquifer, which supplies most of the water used in the State. The Biscayne aquifer of southeast Florida, although limited in areal extent compared to the Floridan aquifer, is also a major source of ground water. Other principal aquifers are the sand-and-gravel aquifer of the western panhandle, and smaller, surficial and intermediate depth aquifers located beneath much of coastal and southern Florida. (USGS)
W84-01004

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER IN FLORIDA, MAY 1980,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. G. Healy.
USGS Map Series No 104, 1982. 1 Sheet Map, 3 Fig, 17 Ref.

Descriptors: *Groundwater, Confined aquifers, *Maps, *Florida, Floridan aquifer, *Potentiometric surface.

The contours depicting the potentiometric surface of the Floridan aquifer for May 1980 were prepared from water levels measured in 1,818 wells. Comparison of the May 1980 potentiometric surface with that of July 1961 shows that the potentiometric surface has not changed appreciably from 1961 to 1980 except in areas of heavy withdrawals. Declines of the potentiometric surface, as shown by a map and hydrographs, range from less than 10 feet throughout most of the State to more than 20 feet in the northwest panhandle (Okaloosa County) and in west-central peninsular Florid (Polk County). (USGS)
W84-01005

SELECTED FLOW CHARACTERISTICS OF FLORIDA STREAMS AND CANALS,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. W. Foose.
USGS Water-Resources Investigations Report 83-4107, 1983. 265 p, 19 Fig, 1 Tab, 4 Ref.

Descriptors: *Low-flow frequency, *Duration table, *Hydrograph, Surface water, *Florida.

Data and statistics on low-flow frequency for 254 stream-gaging stations on Florida streams and canals are presented. The selected stations have 10 or more years of continuous record. A site description, a 10-year hydrograph, and a table of flow duration are presented for each station. A computed monthly 7-day, 10-year low flow is presented for 142 stations with flow patterns not significantly altered by controls or affected by other influences. (USGS)
W84-01012

WATER RESOURCES OF THE SANTA FE RIVER BASIN, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-01013

FLOOD PROFILES IN THE CALAPOOYA CREEK BASIN, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
J. Friday.
Available from the OFSS, USGS, Lakewood CO 80225; Paper copy $4.50, Microfiche $3.50. USGS Open-File Report 82-439, 1982. 30 p, 7 Sheet maps, 16 Fig, 3 Tab, 4 Ref.

Descriptors: *Floods, *Flood profiles, *Floodway, Surcharge, Computer model, *Oregon, Douglas County, Umpqua River, Calapooya Creek basin.

Water-surface profiles were computed for a 19.4-mile reach of Calapooya Creek in Douglas County, Oregon. The data will enable the county to evaluate flood hazards in the floodprone areas in the reach. Profiles for floods having recurrence intervals of 2, 10, 50, 100, and 500 years are shown in graphic and tabular form. A floodway, allowing encroachment of the 100-year floods, was designed with a maximum 1.0-foot surcharge limitation. A profile for a flood that occurred in November 1961 is also presented. All data were derived from a digital computer model developed for the study. (USGS)
W84-01021

WATER RESOURCES OF MANATEE COUNTY FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W84-01026

WATER RESOURCES DATA, NORTH CAROLINA, WATER YEAR 1982,
Geological Survey, Raleigh, NC. Water Resources Div.
H. C. Gunter, C. L. Hill, and T. E. Dillard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243881, Price codes: A21 in paper copy, A01 in microfiche. USGS Water-Data Report NC-82-1, 1982. 481 p, 9 Fig, 1 Tab. Prepared in cooperation with the State of North Carolina and with other agencies.

Descriptors: *North Carolina, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water Resources data for the 1982 water year for North Carolina consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 143 gaging stations and stage and contents for 25 lakes and reservoirs; water quality for 86 gaging stations and 3 miscellaneous sites; and water levels for 56 observation wells. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements in this report. (USGS)
W84-01028

SMALL-STREAM FLOOD INVESTIGATIONS IN MINNESOTA, OCTOBER 1958 TO SEPTEMBER 1980,
Geological Survey, St. Paul, MN. Water Resources Div.
K. T. Gunard, and C. J. Smith.
USGS Open-File Report 82-433, May 1982. 221 p, 9 Fig, 1 Tab, 8 Ref.

Descriptors: *Small watersheds, *Minnesota, *Peak discharge, *Floods, Streamflow, Gaging stations, Flow characteristics, Stage-discharge relations, Basin characteristics, Flood depth.

An investigation of flood flows from small drainage basins in Minnesota is being made to aid in the design of bridges, culverts and other highway drainage structures. Results of the investigation provide peak-flow data on streams generally with drainage areas less than 200 square miles, placing particular emphasis on those with drainage areas lees than 10 square miles. Basin parameters being investigated for their effect on floods are drainage area, length of main stream, slope of main channel, basin altitude, forest cover, and storage area. All of the 187 gaging stations included in the report are equipped with crest-stage gages. In addition, 4 stations are equipped to record stage and precipitation continuously. The relative magnitude of flood flows for different hydrologic regions is shown in graphs that relate maximum discharge to drainage area. Station records contain location, drainage area, records available, type of gage, on-site structure elevations, bankfull stage, and annual maximum stage and discharge data. These data, with annual peak data from continuous-record stations, form the basis for statewide flood-frequency studies. (USGS)
W84-01033

GENERALIZED CONFIGURATION OF THE TOP OF THE LIMESTONE UNIT OF THE LOWER PART OF THE SURFICIAL AQUIFER, DUVAL COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. M. Speechler.
USGS Open-File Report 82-336, 1982. 1 Sheet map, 2 Fig, 1 Tab, 6 Ref.

Descriptors: Geology, *Stratigraphy, *Aquifers, Surficial aquifer, Duval County, *Florida.

The top of the limestone unit ranges from about 25 feet above sea level in western Duval County to about 75 feet below sea level locally in the eastern part of the county. The limestone, which is part of the surficial aquifer, is the principal source of water to shallow wells in the county. The unit generally consists of a soft, friable, cavernous, sandy limestone, which ranges from about 5 to 40 feet in thickness. Along the coast and in the southern part of the county, the limestone becomes discontinuous. (USGS)
W84-01037

ANNUAL SNOWMELT AND RAINFALL PEAK-FLOW DATA ON SELECTED FOOTHILLS REGION STREAMS, SOUTH PLATTE RIVER ARKANSAS RIVER, AND COLORADO RIVER BASINS, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. G. Elliott, R. D. Jarrett, and J. L. Ebling.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $11.50 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-426, 1982. 86 p, 7 Fig, 1 Tab, 25 Ref.

Descriptors: *Flood hydrology, *Peak discharge, *Snowmelt hydrograph, *Rainfall hydrograph, Foothills region, Mixed population, Data collection, *Colorado, *South Platte River basin, Arkansas River basin, Colorado River basin.

Peak flows in the foothills region of Colorado are attributable to two meteorological sources--snowmelt and rainfall. As part of a study of the hydrology of foothills streams in Colorado, charts from streamflow gages on unregulated streams were examined to determined the source of peak-flow events. Snowmelt-runoff peaks were distinguished from rainfall-runoff peaks on the basis of daily and seasonal occurrence, hydrograph shape, and local weather conditions. Peak-flow data for snowmelt runoff and rainfall runoff are presented for 69 streamflow-gaging stations in the South Platte River, the Arkansas River, and the Colorado River basins. (USGS)
W84-01038

IDENTIFICATION AND CLASSIFICATION OF PERENNIAL STREAMS OF ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
R. A. Hunrichs.
USGS Water-Resources Investigations Report 83-4063, 1983. 1 Sheet map, 7 Fig, 6 Ref.

Descriptors: *Perennial stream, *Low flow, Frequency analysis, *Arkansas, Recurrence intervals, *Classification.

Perennial streams are identified in a map and classified according to the relative magnitude of their 7-day, 10-year low flows. Perennial streams are identified for the entire State of Arkansas with the exception of the Mississippi Alluvial Plain. Also presented are the 7-day, 10-year low flow values at continuous-record and low-flow partial-record stations statewide. Perennial streams are defined in this report as having 7-day, 10-year low flows greater than zero. The perennial stream drainage was delineated using data from continuous-record and low-flow partial-record stations, and reconnaissance-site observations. The reconnaissance was conducted during the unusually dry summer of 1980. In analysis, the State was divided into hydrologic regions; they were used in conjunction with index stations to establish the recurrence intervals of flow observed, during the reconnaissance. When necessary, relations were developed by region to adjust observed flow to 10-year recurrence interval flows. (USGS)
W84-01041

HYDROLOGY OF AREA 49, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, MONTANA AND WYOMING,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2A.
W84-01043

WATER RESOURCES DATA FOR PUERTO RICO, 1981-82,
Geological Survey, San Juan, PR. Water Resources Div.
R. E. Curtis, P. W. McKinley, and H. M. Colon-Ramos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-114701, Price codes: A18 in paper copy, A01 in microfiche. USGS Water-Data Report PR-81-82-1, (March 1983). 414 p, 25 Fig, 3 Tab.

Descriptors: *Puerto Rico, *Surface water, *Water quality, *Groundwater, Aquifers, Chemical analysis, Gaging stations, *Hydrologic data, Sediments, Streamflow, Water analysis, Water levels, Lakes, Sampling sites, *Data collection.

Water-resources data for surface-water, quality-of-water, and ground-water records for 1981-82 water years for Puerto Rico consist of records of discharge, water quality of streams, and water levels of wells. This report contains discharge and water-quality records for 40 gaging stations, 109 water-quality stations, stage records for 3 lakes, and water levels for 61 observation wells. Also included are data for 17 crest-stage partial-record stations. (USGS)
W84-01044

TRENDS IN GROUND-WATER LEVELS IN WISCONSIN THROUGH 1981,
Geological Survey, Madison, WI. Water Resources Div.
R. M. Erickson, and R. D. Cotter.
University of Wisconsin-Extension, Madison, Geological and Natural History Survey, Information Circular No 43, 1983. 139 p, 15 Fig, 3 Tab, 4 Ref.

Descriptors: *Well hydrographs, *Water-level fluctuations, Groundwater, *Groundwater levels, Well hydrographs, Observation wells, *Wisconsin.

A summary of ground-water-level trends in Wisconsin through 1981 is displayed on hydrographs from more than 200 wells. These hydrographs display fluctuations in the potentiometric surface of confined and unconfined aquifers. The graphs are plotted from periodic (weekly or monthly) measurements and from continuous-recording gage records. Two hundred and ten hydrographs having periods of record of at least 5 years between 1934 and 1981 are included. Records on 11 wells date from the 1930's and 78 have more than 30 years of measurements. The water-level changes shown represent both natural fluctuations reflecting climatic control, and declines or recovery brought about by pumping or cessations of pumping of ground water. Wisconsin's principal aquifers are sand and gravel, sandstone, and dolomite. The depth of wells utilized in the report ranges from 11 to 1,908 feet. (USGS)
W84-01047

MEASUREMENT AND COMPUTATION OF STREAMFLOW: VOLUME 2. COMPUTATION OF DISCHARGE,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W84-01049

8. ENGINEERING WORKS

8A. Structures

ANNAPOLIS POINTS THE WAY FOR FUNDY,
J. C. Whitaker.
International Water Power and Dam Construction, Vol 34, No 7, p 23-25, July, 1982. 1 Fig, 2 Tab.

Descriptors: *Tidal powerplants, *Tidal energy, *Pilot plants, *Project planning, *Electric power production, Powerplants, Tidal hydraulics, Turbines, Hydraulic turbines, Design criteria, Hydroelectric power, *Nova Scotia.

As the tidal power project at Annapolis Royal, Nova Scotia nears completion, decisions will be made as to whether to continue plans for the much larger Bay of Fundy tidal project. Should the pilot program prove successful, significant savings could be realized if Straflo turbines are substituted for conventional bulb turbines in the Bay of Fundy tidal power project. With this savings in mind, the Federal Department of Energy, Mines, and Resources added $25 million to the $46 million alloted for testing the Straflo design. The pilot plant will be linked to the provincial grid through a 5 km transmission line to the Lequille hydro plant substation. The Straflo unit is being made by Dominion Bridge Company of Montreal and Sulzer Canada, a company out of Switzerland. The main parameters of the Annapolis turbine and the construction progress are discussed. United States financing of the Fundy project in exchange for energy is expected to reduce the amount of fuel consumed in the New York and New England areas. (Geiger-FRC)
W84-00972

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

WATER-RESOURCES INVESTIGATIONS IN NORTH DAKOTA--FISCAL YEAR 1983,
Geological Survey, Bismarck, ND. Water Resources Div.
N. K. Lankford, and L. L. Albright.

USGS Open-File Report 83-220, March 1983. 51 p, 4 Fig.

Descriptors: Water resources, Hydrology, Groundwater, Surface water, Water quality, Hydrologic data collections, *North Dakota.

All ongoing water resources projects in North Dakota in fiscal year 1983, are listed. The report was prepared to inform interested federal, State, and local agencies and private individuals of the activities of the Water Resources Division in the State. Information on each project includes objectives, approach, progress in 1982, plans for 1983, completed and planned report products, and the name of the project chief. (USGS)
W84-00888

9D. Grants, Contracts, and Research Act Allotments

ACTIVITIES IN IDAHO, STATUS OF PROJECTS, FISCAL YEARS 1982-83.
Geological Survey, Boise, ID. Water Resources Div.
Available from the OFSS, USGS, Box 25, Denver, CO 80225; $6.00 in paper copy, $3.50 in microfiche. USGS Open-File Report 83-40, December 1982. 45 p, 8 Fig, Channel, L.K., compiler.

Descriptors: Hydrology, Hydraulics, Geology, Geophysics, Geochemistry, Water resources, Groundwater, Surface water, Quality of water, Geothermal resources, Monitoring, Model studies, Sediment transport, Sole-source aquifers, *Idaho, *Cooperative funding agreements, *Training, Education.

Twenty-three projects were conducted by the Water Resources Division of the U.S. Geological Survey in Idaho during FY's (fiscal year) 1982-83. These projects were done in cooperation with seven State and local and nine federal agencies. State and local cooperative funding amounted to $566,123 in FY 1982 and $570,000 (projected monies) in FY 1983; Federal funding amounted to $2,083,748 in FY 1982 and $1,656,494 (projected monies) in FY 1983. Eighty-three persons were employed as of September, FY 1982--40 full time and 43 other than full time. Sixty-five persons were employed as of October, FY 1983--35 full time and 30 other than full time. In addition, the Water Resources Division maintains a project office at the Idaho National Engineering Laboratory. Work there is done in cooperation with the U.S. Department of Energy, which provides most of the funding. Some Federal funds are provided for special projects. Projects other than continuing programs for collection of hydrologic data included flood-mapping studies, geothermal-resource investigations, groundwater-quality assessments, basin-and region-wide water-resource investigations, river quality-of-water monitoring studies, volcanic-ash-related studies, groundwater trends and stream gaging-program evaluations, river erosion and sediment-transport studies, water-budget and groundwater-use determinations, and a sole-source aquifer appraisal. (USGS)
W84-00835

FUNDING HISTORY OF THE U.S. GEOLOGICAL SURVEY FEDERAL DATA COLLECTION AND ANALYSIS PROGRAM,
Geological Survey, Reston, VA. Water Resources Div.
A. Condes de la Torre.
USGS Open-File Report 83-47, 1983. 14 p, 6 Fig, 8 Ref.

Descriptors: Adjudication, Compacts, Treaties, *National Stream Quality Accounting Network, National Hydrologic Benchmark Network funding, *Hydrologic data collection, *Federal program.

Federal program activities in the collection and analysis of hydrologic data are funded in six categories established in order of priority. Over the period 1973 to 1982, the funding available for the programs supported in each category has increased, but when viewed without the effect of inflation the purchasing power of the programs has generally decreased. Funding for adjudications, compacts, and treaties increased continuously from $588,600 in 1973 to $1,035,500 in 1981, and then decreased to $1,014,200 in 1982. However, when adjusted for inflation, based on a 1972 constant dollar, the constant dollars decreased from $555,800 in 1973 to $411,900 in 1982, which indicates that purchasing power was 26% less in 1982 than in 1973. Funding for the other five categories--the National Stream Quality Accounting Network, National Benchmark Network, Other Federal Agencies within the Department of the Interior, and General Federal Agencies Outside the Department of the Interior, and General Federal Hydrologic Interests--increased during the period, but the funding increase did not keep pace with inflation. During this 1973-82 period the U.S. Geological Survey has worked to make the Federal Data Collection and Analysis Program more cost effective by more efficient operational procedures and improved instrumentation, laboratory, and computation procedures. (USGS)
W84-00836

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition And Processing

DEFINITIONS OF COMPONENTS OF THE MASTER WATER DATA INDEX MAINTAINED BY THE NATIONAL WATER DATA EXCHANGE,
Geological Survey, Reston, VA. Water Resources Div.
R. A. Perry, and O. O. Williams.
Available from the OFSS, USGS Lakewood, CO. 80225, Prices: $35.75 in paper copy, $4.00 in microfiche. USGS Open-File Report 82-327, 1982. 269 p, 2 Fig, 2 Tab, 34 Ref.

Descriptors: *Information systems, *Information retrieval, Data processing, Documentation, *Indexes, Surface waters, Groundwater, Water quality, *National Water Data Exchange, Dictionaries, *Water data sites, System 2000, *Data base management systems, Data dissemination.

The Master Water Data Index is a computerized data base developed and maintained by the National Water Data Exchange (NAWDEX). The Index contains information about water-data collection sites. This information includes: the identification of new sites for which water data are available, the locations of these sites, the type of site, the data-collection organization, the types of data available, the major water-data parameters for which data are available, the frequency at which these parameters are measured, the period of time for which data are available, and the medial in which the data are stored. This document, commonly referred to as the MWDI data dictionary, contains a definition and description of each component of the Master Water Data Index data base. (USGS)
W84-00778

10C. Secondary Publication And Distribution

ANNOTATED REPORT AND DATA INVENTORY FOR THE MISSISSIPPI RIVER QUALITY-ASSESSMENT, MINNEAPOLIS-ST. PAUL METROPOLITAN AREA,
Geological Survey, St. Paul, MN. Water Resources Div.
T. A. Winterstein.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $13.00 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-869, September 1982, 104 p.

Descriptors: *Bibliographies, *Abstracts, *Mississippi River, Water quality, Basic-data collections, Dissolved oxygen, Water chemistry, Water pollution effects, Aquatic life, Freshwater fish, Mussels, Aquatic plants, Aquatic algae, Nutrients, Biochemical-oxygen demand, *River-quality-assessment project, *Minnesota River, St. Croix River, Minneapolis-St. Paul metropolitan area.

This inventory of reports and data concerning the Mississippi and Minnesota Rivers in the Twin Cities metropolitan area was compiled from November 1981 through January 1982 for a planned river-quality assessment to be conducted cooperatively by the U.S. Geological Survey and the Metropolitan Waste Control Commission. There are 260 annotated citations: 176 citations of reports; 8 citations of computer models that have been used to model either or both rivers; and 76 citations of data in reports, in field notes, lab sheets, or handwritten tabulations, and in computer data bases. Citations of all the reports and data located that might conceivably be useful in understanding and interpreting the biological and chemical quality of the Mississippi and Minnesota Rivers in the past, present, or future were included. The accuracy of the citations was not verified and secondary sources, such as other annotated bibliographies, were used in the compilation of this inventory. (USGS)
W84-00860

LITERATURE ASSESSMENT OF THE CHARLOTTE HARBOR ESTUARINE SYSTEM AND SURROUNDING AREA, SOUTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
Y. E. Stoker, and G. A. Karavitis.
USGS Open-File Report 83-127, 1983. 134 p, 1 Fig, 1289 Ref.

Descriptors: *Bibliographies, *Water quality, *Estuary, Freshwater inflow, *Marine resources, *Model studies, Fisheries, Groundwater, Surface water, Waste-load, Water use, *Charlotte Harbor, Peace River basin, Myakka River basin, Caloosahatchee River basin, Impacts, Biological assessment, Circulation, Radiochemicals, *Florida.

The Governor of Florida established the Charlotte Harbor Resource Planning and Management committee to recommend the course of action Florida should take in planning for potential growth in the rapidly growing area surrounding Charlotte Harbor. In May 1981, the U.S. Geological Survey began a planning study to determine detailed hydrologic study needs of the Charlotte Harbor area. A literature search of available data and reports pertaining to the Charlotte Harbor estuarine system and surrounding area resulted in almost 1,300 references. This report contains all references collected during this search. Some of the major reference topics are altered freshwater flow, water quality of the harbor and drainage systems, circulation and tides, coastal and marine resources, fisheries, geology and hydrology of the area, impact studies, water resources, flora and fauna of the area, and water supply. Sixty-eight key words or subject identifiers are used to the index report. (USGS)
W84-00992

10D. Specialized Information Center Services

DIRECTORY OF ASSISTANCE CENTERS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX),
Geological Survey, Reston, VA. Water Resources Div.
B. M. Josefson, and C. D. Blackwell.
Available from the USGS, OFSS, Lakewood, CO 80225. Price: $4.50 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-925, 1982. 31 p, append.

Descriptors: *Assistance centers, Water data, Data assistance, *Information exchange, *Data storage and retrieval, Cooperatives, *Indexing, Assistance centers, Directory, *National Water Data Exchange(NAWDEX).

The National Water Data Exchange (NAWDEX), managed by the U.S. Geological Survey, has established a network of Assistance Centers throughout the United States and Puerto Rico to assist users of water data in identifying and locating the data they need. This Directory provides the information needed to contact any of the established Centers. (USGS)
W84-00814

DEFINITIONS OF COMPONENTS OF THE WATER DATA SOURCES DIRECTORY MAINTAINED BY THE NATIONAL WATER DATA EXCHANGE,
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards.
Available from the OFSS, USGS Lakewood CO 80225, Price: $16.75 in paper copy, $4.50 in microfiche. USGS Open-File Report 82-923, 1982. 126 p, 3 Fig, 10 Ref.

Descriptors: *Information retrieval, *Data storage and retrieval, Organizations, Water sources, Publications documentation, Surface water, Groundwater, Water quality, *National Water Data Exchange(NAWDEX), Data definitions, SYSTEM 2000, *Data base management systems, Data dissemination.

This report contains a definition and description of each component of the Water Data Sources Directory data base maintained by the National Water Data Exchange (NAWDEX). It is intended, primarily, to assist those persons using the Water Data Sources Directory in understanding information obtained from the data base. The Water Data Sources Directory is a computerized data base maintained and operated using the System 2000 data base management system. It contains information about organizations that collect, store, and disseminate water data. (USGS)
W84-00815

DIRECTORY OF MEMBER ORGANIZATIONS OF THE NAITONAL WATER DATA EXCHANGE (NAWDEX),
Geological Survey, Reston, VA. Water Resources Div.
C. D. Blackwell, and J. M. Nokes.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $9.50 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-902, 1982. 66 p.

Descriptors: Organizations, *Information exchange, *Information systems, *NAWDEX membership, *Directories, Information retrieval, Data collections, *Data storage and retrieval.

The National Water Data Exchange (NAWDEX) is a national confederation of water-oriented organizations working together to improve access to water data. It consists of member organizations from all sectors of the water-data community. This Directory provides the names, addresses, and telephone numbers of all NAWDEX member organizations and their designated NAWDEX representatives. (USGS)
W84-00816

INDENTIFICATION CODES FOR ORGANIZATIONS LISTED IN COMPUTERIZED DATA SYSTEMS OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards, and B. M. Josefson.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $15.25 in paper copy, $3.50 in microfiche. USGS Open-File Report 82-921, 1982 (supersedes Open-File Report 81-904), 1982. 114 p, 1 Fig, 2 Ref.

Descriptors: *Data storage and retrieval, *Information and exchange, *Organizations, Indexing, Data transmission, *Organization identification code, Computerized data systems, *U.S. Geological Survey, National Water Data Exchange (NAWDEX).

This report contains codes for the identification of public and private organizations listed in computerized data systems. These codes are used by the U.S. Geological Survey's National Water Data Exchange (NAWDEX), National Water Data Storage and Retrieval System (WATSTORE), National Cartographic Information Center (NCIC), Office of Water Data Coordination (OWDC). The format structure of the codes is discussed and instructions are given for requesting new codes. (USGS)
W84-00817

REVISED DESCRIPTION OF INDEX OF FLORIDA WATER DATA COLLECTION ACTIVE STATIONS AND A USER'S GUIDE FOR STATION OR SITE INFORMATION RETRIEVAL COMPUTER PROGRAM FINDEX H578,
Geological Survey, Tallahassee, FL. Water Resources Div.
L. H. Geiger.
USGS Open-File Report 83-37, 1983. 76 p, 16 Fig, 3 Tab, 1 Ref.

Descriptors: *Computer program, *Hydrologic data, Data collection, *FINDEX, FNDXUP, FNDXST.

The report is an update of U.S. Geological Survey Open-File Report 77-703, which described a retrieval program for administrative index of active data-collection sites in Florida. Extensive changes to the Findex system have been made since 1977, making the previous report obsolete. A description of the data base and computer programs that are available in the Findex system are documented in this report. This system serves a vital need in the administration of the many and diverse water-data collection activities. District offices with extensive data-collection activities will benefit from the documentation of the system. Largely descriptive, the report tells how a file of computer card images has been established which contains entries for all sites in Florida at which there is currently a water-data collection activity. Entries include information such as identification number, station name, location, type of site, county, frequency of data collection, funding, and other pertinent details. The computer program FINDEX selectively retrieves entries and lists them in a format suitable for publication. The index is updated routinely. (USGS)
W84-00885

SUBJECT INDEX

ABSTRACTS
Annotated Report and Data Inventory for the Mississippi River Quality-Assessment, Minneapolis-St. Paul Metropolitan Area,
W84-00860 10C

ACID MINE DRAINAGE
The State Water Plan, Subbasin 17, Central Allegheny River.
W84-00784 6D

The State Water Plan, Subbasin 18, Lower Allegheny River.
W84-00786 5B

The State Water Plan, Subbasin 20, Ohio River.
W84-00787 5B

Subbasin 11, Upper Juniata River,
W84-00839 6B

State Water Plan: Subbasin 9, Central West Branch Susquehanna River.
W84-00844 6B

State Water Plan: Subbasin 8, Upper West Branch Susquehanna River.
W84-00845 5B

State Water Plan: Subbasin 5, Upper Central Susquehanna River.
W84-00848 6B

State Water Plan: Subbasin 4, Upper Susquehanna River.
W84-00849 6B

ACID RAIN
Hydrogeochemical Cycling in a Watershed-Groundwater System: Fort River and Cadwell Creek, Massachusetts,
W84-00967 5B

ACID STREAMS
Hydrogeochemical Cycling in a Watershed-Groundwater System: Fort River and Cadwell Creek, Massachusetts,
W84-00967 5B

ACIDIC SOILS
Hydrogeochemical Cycling in a Watershed-Groundwater System: Fort River and Cadwell Creek, Massachusetts,
W84-00967 5B

ACIDIC WATER
State Water Plan: Subbasin 8, Upper West Branch Susquehanna River.
W84-00845 5B

ADDITIVES
Reducing and Monitoring Corrosion in MSF Evaporators in the Change-Over From Acid Treatment to Treatment with Additives,
W84-00753 3A

ADVANCED WASTEWATER TREATMENT
Advanced Treatment of Secondary Sewage Effluent by Membrane Process,
W84-00760 5D

AEOLIAN SOILS
A Natural Resource and Land Use Analysis of the Lacona Williamstown Portion of the Tug Hill Aquifer.
W84-00913 2F

AGRICULTURAL RUNOFF
State Water Plan: Subbasin 10, Lower West Branch Susquehanna River.
W84-00843 6B

Transport Modeling of an Agricultural Herbicide, A Laboratory Simulation,
W84-00969 5B

Quality of Runoff From Small Watersheds in the Twin Cities Metropolitan Area, Minnesota--Hydrologic Data for 1980,
W84-00982 7C

AGRICULTURAL WATERSHEDS
Nitrate Loss from Agricultural Drainage Waters: Implications for Nonpoint Source Control,
W84-00965 5B

Water-Quality and Fluvial-Sediment Characteristics of Selected Streams in Northeast Kansas,
W84-01045 2J

AGRICULTURE
State Water Plan: Subbasin 6, Lower Central Susquehanna River.
W84-00847 6D

ALCOHOLS
Membrane Technology Applied to Bioconversion of Macromolecular Substrates and Upgrading of Products. A Model Study on Ethanol Production from Cellulose,
W84-00709 3A

ALGAE
Reconnaissance of Stream Biota and Physical and Chemical Quality from Selected Land Use on Stream Biology in the Coal-Mining Region, Southwestern Indiana, 1979-80,
W84-00876 5B

ALKALINE SOILS
Hydrogeochemical Cycling in a Watershed-Groundwater System: Fort River and Cadwell Creek, Massachusetts,
W84-00967 5B

ALLUVIAL AQUIFER
Hydrogeologic Features of the Alluvial Deposits in the Owl Creek Valley, Bighorn Basin, Wyoming,
W84-00770 2F

ALLUVIAL AQUIFERS
Use of a Three-Dimensional Model for the Analysis of the Ground-Water Flow System in Parker Valley, Arizona and California,
W84-00823 2F

ALLUVIAL CHANNELS
Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming, Part IV. Bed Elevations, 1980,
W84-00936 7C

ALLUVIAL THICKNESS
Gravity Survey of Dixie Valley, West-Central Nevada,
W84-01000 2F

ALLUVIUM
Water Information for Northwestern Missouri--A Planning Document,
W84-00810 3B

Mineralogy of Fine-Grained Alluvium from Borehole U11g, Expl. 1, Northern Frenchman Flat Area, Nevada Test Site,
W84-00946 2J

ALTERNATIVE PLANNING
Morris County Master Plan: Water Supply Element.
W84-00788 6D

AMERICAN RIVER
Water-Quality Assessment of the American River, California,
W84-00828 5B

ANAEROBIC CONDITIONS
Subbasin 15, Lake Erie,
W84-00840 6B

ANALYSIS OF VARIANCE
Reconnaissance for Determining Effects of Land Use and Surficial Geology on Concentrations of Selected Elements on Streambed Materials from the Coal Mining, Region, Southwestern Indiana, October 1979 to March 1980,
W84-00771 5B

ANALYTICAL TECHNIQUES
Quality Assurance Practices for the Chemical and Physical Analyses of Water and Fluvial Sediments,
W84-00812 5A

APPROXIMATION METHOD
Percentage Change in Saturated Thickness of the High Plains Aquifer, West-Central Kansas, 1950 to Average 1980-82,
W84-00821 7C

AQUATIC ENVIRONMENT
Reconnaissance of Stream Biota and Physical and Chemical Quality from Selected Land Use on Stream Biology in the Coal-Mining Region, Southwestern Indiana, 1979-80,
W84-00876 5B

AQUATIC HABITATS
State Water Plan: Subbasin 8, Upper West Branch Susquehanna River.
W84-00845 5B

AQUATIC MICROBIOLOGY
Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

AQUICLUDES
Water Resources of the Santa Fe River Basin, Florida,
W84-01013 2F

AQUIFER
Ground-Water Resources of the White River Basin, Delaware County, Indiana, 1977,
W84-00931 2F

Geohydrology of the High Plains Aquifer System in Nebraska,
W84-01002 7C

AQUIFER CHARACTERISTICS
Digital Model Evaluation of the Predevelopment Flow System of the Tertiary Limestone Aquifer, Southeast Georgia, Northeast Florida, and Southern South Carolina,
W84-00779 2F

The State Water Plan, Subbasin 17, Central Allegheny River.
W84-00784 6D

Geology and Ground-Water Resources of Salem County, New Jersey,
W84-00795 2F

Geology and Ground-Water Resources of the Rahway Area, New Jersey,
W84-00796 2F

Ground-Water Resources of Essex County, New Jersey,
W84-00797 2F

Water Resources and Geology of Gloucester County, New Jersey,
W84-00798 2F

Predevelopment Flow in the Tertiary Limestone Aquifer, Southeastern United States: A Regional Analysis From Digital Modeling,
W84-00884 2F

Ground Water and Geology of Marquette County, Michigan,
W84-00925 2F

AQUIFER CHARACTERISTICS

Ground-Water Resources of the White River Basin, Delaware County, Indiana, 1977,
W84-00931 2F

Appraisal of Water From the Pelican River Sand-Plain Aquifer, West-Central Minnesota,
W84-00988 2F

Impact of Changes in Land Use on the Ground-Water System in The Sequim-Dungeness Peninsula, Clallam County, Washington,
W84-01014 4C

Hydrologic Analysis of the Upper San Pedro Basin from the Mexico-United States International Boundary to Fairbank, Arizona,
W84-01023 2A

Hydrogeology of the Providence Aquifer of Southwest Georgia,
W84-01031 2F

AQUIFER RECHARGE

The Economic Value of Ground Water Recharge for Irrigation Use,
W84-00957 4B

AQUIFER SYSTEMS

Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan,
W84-01008 2F

AQUIFER TESTS

Results of Hydraulic Tests in U.S. Department of Energy's Wells Doe-4, 5, 6, 7, 8 and 9, Salt Valley, Grand County, Utah,
W84-01039 2F

AQUIFERS

Modifications and Corrections to the Finite Difference Model for Simulation of Three-Dimensional Ground-Water Flow,
W84-00776 2F

Geology and Ground-Water Resources of Salem County, New Jersey,
W84-00795 2F

Geology and Ground-Water Resources of the Rahway Area, New Jersey,
W84-00796 2F

Ground-Water Resources of Essex County, New Jersey,
W84-00797 2F

Semiannual Water-Level and Potentiometric Contours of Two Water-Yielding Zones in the Surficial Aquifer, 1975-79, Naples, Florida,
W84-00803 7C

Saturated Thickness of the High Plains Regional Aquifer in 1980, Northwestern Oklahoma,
W84-00804 7C

Geohydrologic Data from Sandstone Aquifers in Southwestern Kansas,
W84-00864 7C

Ground-Water Levels in Selected Well Fields and in West-Central Florida, May 1982,
W84-00867 7C

Potentiometric-Surface Map of Water in the Lakota Formation and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00881 7C

Potentiometric-Surface Map of Water in the Fox Hills Lower Hell Creek Aquifer in the Northern Great Plains are of Montana,
W84-00903 7C

A Natural Resource and Land Use Analysis of the Lacona Williamstown Portion of the Tug Hill Aquifer.
W84-00913 2F

Water-Level Maps of the Alluvial Aquifer, Northwestern Mississippi September 1981,
W84-00921 7C

Ground-Water Resources of the White River Basin, Hamilton and Tipton Counties, Indiana,
W84-00930 2F

Index of Hydrologic Data for Selected Sites in Broward County, Florida, 1939-80,
W84-00943 7C

Potential Hydrologic Impacts of Ground-Water Withdrawals from the Cape Cod National Seashore, Truro, Massachusetts,
W84-00944 2F

Potentiometric-Surface Map of Water in the Eagle Sandstone and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00949 7C

Major Aquifers in Hanson and Davison Counties, South Dakota,
W84-00978 2F

Major Aquifers in Yankton County, South Dakota,
W84-00979 2F

Atlas of Eleven Selected Aquifers in New York,
W84-00983 7C

Geohydrology of the Floridan Aquifer in the Withlacoochee River Basin of the Southwest Florida Water Management District,
W84-00984 7C

Principal Aquifers in Florida,
W84-01004 7C

Water Resources of the Santa Fe River Basin, Florida,
W84-01013 2F

Evaluation of the Hydrologic System in the New Leipzig Coal Area, Grant and Hettinger Counties, North Dakota,
W84-01022 2F

Generalized Configuration of the Top of the Limestone Unit of the Lower Part of the Surficial Aquifer, Duval County, Florida,
W84-01037 7C

Ground-Water Resources of Ransom and Sargent Counties, North Dakota,
W84-01050 2F

AQUIFERS *FRESHWATER-SALINE WATER INTERFACES

Preliminary Survey of Ground-Water Resources for Island County, Washington,
W84-00878 2F

ARCHAEOLOGY

Historic and Prehistoric Patterns of Water Use in the Connecticut River Valley: Implications for Water Resources Planning,
W84-00968 6D

AREAL HYDROGEOLOGY

Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

Long Range Plans for Hydrologic Investigations,
W84-00852 6B

AREAL PRECIPITATION

Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

ARIZONA

Map Showing Groundwater Conditions in the Tonto Basin Area, Gila County, Arizona--1979,
W84-00807 7C

Use of a Three-Dimensional Model for the Analysis of the Ground-Water Flow System in Parker Valley, Arizona and California,
W84-00823 2F

Annual Summary of Ground-Water Conditions in Arizona, Spring 1981 to Spring 1982,
W84-00824 7C

Floods of November 1978 to March 1979 in Arizona and West-Central New Mexico,
W84-00837 7C

Annual Summary of Ground-Water Conditions in Arizona, Spring 1980 to Spring 1981.
W84-00941 7C

Floods of October 1977 in Southern Arizona and March 1978 in Central Arizona,
W84-00953 2E

Hydrologic Analysis of the Upper San Pedro Basin from the Mexico-United States International Boundary to Fairbank, Arizona,
W84-01023 2A

ARKANSAS

Ground-Water Levels in Arkansas, Spring 1982,
W84-00870 7C

Discharge Data at Water-Quality Monitoring Stations in Arkansas, 1980 Water Year,
W84-00887 7C

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1982 Water Year,
W84-00891 7C

Time of Travel of Selected Arkansas Streams,
W84-00895 2E

Reconnaissance of Stormwater-Runoff Water Quality of the Big Piney Creek Segment of the Cedar-Piney Watershed, Yell County, Arkansas,
W84-00933 5B

Identification and Classification of Perennial Streams of Arkansas,
W84-01041 7C

ARKANSAS RIVER

Analysis and Computer Simulation of Stream-Aquifer Hydrology, Arkansas River Valley, Southwestern Kansas,
W84-01016 2A

Evaluation of Selected One-Dimensional Stream Water Quality Models with Field Data,
W84-01027 5B

ARKANSAS RIVER BASIN

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1982 Water Year,
W84-00891 7C

AROMATIC HYDROCARBONS

Hydrocarbon Fuels in Ground Water--Increased Awareness and Concern in New Mexico,
W84-00854 5B

ARTIFICIAL RECHARGE

Geohydrologic Reconnaissance of Drainage Wells in Florida--An Interim Report,
W84-00865 4B

An Engineering Economic Analysis of Artificial Recharge in a Conjunctive Irrigation Plan in the Columbia Basin Project, Washington,
W84-00989 4B

ASSISTANCE CENTERS

Directory of Assistance Centers of the National Water Data Exchange (NAWDEX),
W84-00814 10D

ATLANTIC COASTAL PLAIN
Digital Model Evaluation of the Predevelopment Flow System of the Tertiary Limestone Aquifer, Southeast Georgia, Northeast Florida, and Southern South Carolina,
W84-00779 2F

ATLAS
Water Resources Resume: State Atlas Sheet No. 23, Parts of Bergen, Morris and Passaic Counties,
W84-00792 7C

Atlas of Eleven Selected Aquifers in New York,
W84-00983 7C

ATRAZINE
Transport Modeling of an Agricultural Herbicide, A Laboratory Simulation,
W84-00969 5B

AUSTRALIA
Desalination in Australia - Past and Future,
W84-00758 3A

BACTERIAL ANALYSIS
Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

BASELINE STUDIES
Baseline Water-Quality Data for Sand-Plain Aquifers in Hubbard, Morrison, Otter Tail, and Wadena Counties, Minnesota,
W84-00882 7C

BASIC DATA
Hydrologic Data for the Pelican River Sands Aquifer, Western Minnesota,
W84-00947 7C

BEDLOAD
Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming: Part III. River Hydraulics and Sediment Transport, 1980,
W84-00937 7C

BENTHIC FAUNA
Hydrology, Water Quality, and Biology of Baptiste Collette Bayou in Relation to the Mississippi River at Venice, Louisiana,
W84-01025 5B

BIBLIOGRAPHIES
Annotated Report and Data Inventory for the Mississippi River Quality-Assessment, Minneapolis-St. Paul Metropolitan Area,
W84-00860 10C

Literature Assessment of the Charlotte Harbor Estuarine System and Surrounding Area, Southwest Florida,
W84-00992 10C

BIOASSAY
Advance in Water Quality Monitoring and the Use of Firefly Luciferine/Luciferase Atp Bioassay,
W84-00769 5D

BIOCHEMICAL OXYGEN DEMAND
Determination of Ultimate Carbonaceous BOD and the Specific Rate Constant (K sub 1),
W84-00805 5A

BIOCHEMISTRY
Membrane Technology and Biotechnology,
W84-00707 3A

BIODEGRADATION
Subbasins 14 and 16, Genesee River and Upper Allegheny River,
W84-00838 6B

BIOLOGICAL SAMPLES
Stream Surveillance and Analysis: Shabakunk Creek and Little Bear Brook Watersheds,
W84-00801 5B

BOREHOLES
Geologic and Well-Construction Data for the H-10 Borehole Complex Near the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico,
W84-00901 5E

BOTTOM SEDIMENTS
Reconnaissance for Determining Effects of Land Use and Surficial Geology on Concentrations of Selected Elements on Streambed Materials from the Coal Mining, Region, Southwestern Indiana, October 1979 to March 1980,
W84-00771 5B

Water-Quality Data for Smith and Bybee Lakes: Portland, Oregon, June to November, 1982,
W84-00890 7C

BRINES
Subbasins 14 and 16, Genesee River and Upper Allegheny River,
W84-00838 6B

BUBBLE GAGES
Installation and Service Manual for U.S. Geological Survey Manometers,
W84-00811 7B

BUFFERS
Nitrate Loss from Agricultural Drainage Waters: Implications for Nonpoint Source Control,
W84-00965 5B

CALIFORNIA
Map of the Antelope Valley-East Kern Water Agency Area, California, Showing Ground-Water Subunits and Areas, and Well Hydrographs, 1962 to 1982,
W84-00820 7C

Use of a Three-Dimensional Model for the Analysis of the Ground-Water Flow System in Parker Valley, Arizona and California,
W84-00823 2F

Water-Quality Assessment of the American River, California,
W84-00828 5B

Water-Quality Assessment of the Merced River, California,
W84-00924 5B

Data for Ground-Water Test Hole near Zamora, Central Valley Aquifer Project, California,
W84-00927 7C

Land Subsidence in the San Joaquin Valley, California, as of 1980,
W84-00932 4B

Water-Quality Data for the American River Basin, California, February-October 1979,
W84-00938 7C

Graphical Method for Estimating Occurrence and Duration of a Critical Low Flow in the Sacramento River at Freeport, California,
W84-00973 5G

Water Resources of Borrego Valley and Vicinity, California, Phase 1--Definition of Geologic and Hydrologic Characteristics of Basin,
W84-00980 7C

Ground Water in the Seaside Area, Monterrey County, California,
W84-00991 2F

Sediment and Stream-Velocity Data for the Sacramento River Near Hood, California, May 1978 to September 1981,
W84-01003 7C

CANALS
Geology of the Ground Water Resources of Mercer County,
W84-00799 2F

CARBON TETRACHLORIDE
Chloroform Contamination in Part of the Alluvial Aquifer, Southwest Louisville, Kentucky,
W84-01030 5B

CARBONACEOUS BIOCHEMICAL OXYGEN DEMAND
Determination of Ultimate Carbonaceous BOD and the Specific Rate Constant (K sub 1),
W84-00805 5A

CARBONATE AQUIFERS
Predevelopment Flow in the Tertiary Limestone Aquifer, Southeastern United States: A Regional Analysis From Digital Modeling,
W84-00884 2F

CATION EXCHANGE
Hydrogeochemical Cycling in a Watershed-Groundwater System: Fort River and Cadwell Creek, Massachusetts,
W84-00967 5B

CHARLOTTE HARBOR
Literature Assessment of the Charlotte Harbor Estuarine System and Surrounding Area, Southwest Florida,
W84-00992 10C

CHEESE
Utilization of the New Mineral UF Membranes for Making Semi-hard Cheeses,
W84-00701 3A

CHEMICAL ANALYSES
Ground-Water Data from Selected Wells in Alluvial Aquifers, Powder River Basin, Northeastern Wyoming,
W84-00830 7C

Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

Reconnaissance of Ground-Water Quality, Eastern Snake River Basin, Idaho,
W84-00974 2F

CHEMICAL ANALYSIS
Iron in Ground Waters of the Magothy and Raritan Formations in Camden and Burlington Counties, New Jersey,
W84-00790 5B

Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

Limnological Characteristics of Wisconsin Lakes,
W84-00794 2H

Mercer County Stormwater Toxics Management Project: Delaware and Raritan Canal Conduit Special Study, Trenton, New Jersey.
W84-00802 5B

Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey: 1981 Annual Report,
W84-00897 5A

Groundwater Quality in New Jersey--An Investigation of Toxic Contaminants,
W84-00912 5B

CHEMICAL ANALYSIS

Hydrogeochemical Cycling in a Watershed-Groundwater System: Fort River and Cadwell Creek, Massachusetts,
W84-00967 5B

Water-Quality and Fluvial-Sediment Characteristics of Selected Streams in Northeast Kansas,
W84-01045 2J

CHEMICAL COAGULATION
Removing Uranium From Drinking Water Supplies: Demonstration of Selected Ion Exchange and Chemical Clarification,
W84-00857 5F

CHEMICAL FLOCCULATION
Removing Uranium From Drinking Water Supplies: Demonstration of Selected Ion Exchange and Chemical Clarification,
W84-00857 5F

CHEMICAL NITRIFYING INHIBITORS
Determination of Ultimate Carbonaceous BOD and the Specific Rate Constant (K sub 1),
W84-00805 5A

CHEMICAL WASTES
Analysis of Water Samples for Toxic Volatile Organic Compounds: State of the Art Methods and Strategies for Sampling,
W84-00851 5A

Hydrocarbon Fuels in Ground Water--Increased Awareness and Concern in New Mexico,
W84-00854 5B

Ground Water Quality in the South of Albuquerque,
W84-00856 5B

Groundwater Quality in New Jersey--An Investigation of Toxic Contaminants,
W84-00912 5B

Nonpoint Sources,
W84-00916 6B

CHLOROFORM
Chloroform Contamination in Part of the Alluvial Aquifer, Southwest Louisville, Kentucky,
W84-01030 5B

CHLOROPHYLL-A ANALYSIS
Water Quality of the Tidal River and Estuary; Hydrologic Data Report, 1981 Water Year with a Section on Chlorophyll-A: Collection and Analysis,
W84-00906 7C

CLARK METHOD
Techniques for Estimating Flood Hydrographs for Ungaged Urban Watersheds,
W84-00940 2E

CLASSIFICATION
Identification and Classification of Perennial Streams of Arkansas,
W84-01041 7C

CLAY TRANSPORT
An Evaluation of Suspended Sediment and Turbidity in Cow Creek, Oregon,
W84-00939 2J

CLAYS
Mineralogy of Fine-Grained Alluvium from Borehole U11g, Expl. 1, Northern Frenchman Flat Area, Nevada Test Site,
W84-00946 2J

CLIMATIC DATA
Historic and Prehistoric Patterns of Water Use in the Connecticut River Valley: Implications for Water Resources Planning,
W84-00968 6D

Data from the Surface-Water Hydrologic Investigations of the Hay Creek Study Area, Montana, and the West Branch Antelope Creek Study Area, North Dakota, October 1976 through April 1982,
W84-00976 7C

COAL HYDROLOGY
Reconnaissance of Stream Biota and Physical and Chemical Quality from Selected Land Use on Stream Biology in the Coal-Mining Region, Southwestern Indiana, 1979-80,
W84-00876 5B

COAL MINE WASTES
The State Water Plan, Subbasin 19, Monongahela River.
W84-00785 6D

The State Water Plan, Subbasin 18, Lower Allegheny River.
W84-00786 5B

Subbasin 11, Upper Juniata River,
W84-00839 6B

COAL MINES
State Water Plan: Subbasin 5, Upper Central Susquehanna River.
W84-00848 6B

Hydrology of Coal-Resource Areas in the Southern Wasatch Plateau, Central Utah,
W84-00893 2A

Potential Effects of Surface Coal Mining on the Hydrology of the Cook Creek Area, Ashland Coal Field, Southeastern Montana,
W84-00899 4C

Water Quality of Coal Deposits and Abandoned Mines, Saginaw County, Michigan,
W84-00926 7C

COAL MINING
Reconnaissance for Determining Effects of Land Use and Surficial Geology on Concentrations of Selected Elements on Streambed Materials from the Coal Mining, Region, Southwestern Indiana, October 1979 to March 1980,
W84-00771 5B

COLIFORMS
Subbasin 15, Lake Erie,
W84-00840 6B

COLORADO
Rainfall-Runoff Data From Small Watersheds in Colorado, October 1977 Through September 1980,
W84-00858 7C

Hydrologic Data for Urban Storm Runoff in the Denver Metropolitan Area, Colorado,
W84-00859 7C

Erosion and Sediment Characteristics of the Southeastern Uinta Basin, Utah and Colorado,
W84-01036 2J

Annual Snowmelt and Rainfall Peak-Flow Data on Selected Foothills Region Streams, South Platte River Arkansas River, and Colorado River Basins, Colorado,
W84-01038 7C

Reservoir-Development Impacts on Surface-Water Quantity and Quality in the Yampa River Basin, Colorado and Wyoming,
W84-01042 4C

COLORADO RIVER
Use of a Three-Dimensional Model for the Analysis of the Ground-Water Flow System in Parker Valley, Arizona and California,
W84-00823 2F

COLUMBIA BASIN PROJECT
An Engineering Economic Analysis of Artificial Recharge in a Conjunctive Irrigation Plan in the Columbia Basin Project, Washington,
W84-00989 4B

COMPOSITE MEMBRANES
Experiments with Desalination of Arabian Gulf Water,
W84-00745 3A

COMPUTER MODEL
Analysis and Computer Simulation of Stream-Aquifer Hydrology, Arkansas River Valley, Southwestern Kansas,
W84-01016 2A

Hydrologic Analysis of the Upper San Pedro Basin from the Mexico-United States International Boundary to Fairbank, Arizona,
W84-01023 2A

COMPUTER MODELING
Integrating Intermittent and Renewable Power Resources into the Hydropower system of the Pacific Northwest,
W84-00958 6A

COMPUTER MODELS
Model Modifications for Simulation of Flow Through Stratified Rocks in Eastern Ohio,
W84-00773 4C

Modifications and Corrections to the Finite Difference Model for Simulation of Three-Dimensional Ground-Water Flow,
W84-00776 2F

Digital Model Evaluation of the Predevelopment Flow System of the Tertiary Limestone Aquifer, Southeast Georgia, Northeast Florida, and Southern South Carolina,
W84-00779 2F

Use of a Three-Dimensional Model for the Analysis of the Ground-Water Flow System in Parker Valley, Arizona and California,
W84-00823 2F

Computer Simulation of Phosphorus Cycling in the Sediment-Water System of Eutrophic Lakes,
W84-00964 2H

Numerical Simulation of Ground-Water Flow in the Lower Satus Creek Basin, Yakima Indian Reservation, Washington,
W84-01010 4B

Geohydrology of the Fresh-Water Aquifer System in the Vicinity of Ocean City, Maryland,
W84-01011 2F

Assessment of the Interconnection Between Tampa Bay and the Floridan Aquifer, Florida,
W84-01019 2F

Evaluation of Selected One-Dimensional Stream Water Quality Models with Field Data,
W84-01027 5B

Reservoir-Development Impacts on Surface-Water Quantity and Quality in the Yampa River Basin, Colorado and Wyoming,
W84-01042 4C

COMPUTER PROGRAM
Revised Description of Index of Florida Water Data Collection Active Stations and a User's Guide for Station or Site Information Retrieval Computer Program Findex H578,
W84-00885 10D

COMPUTER PROGRAMS
Microcomputer Computation of Water Quality Discharges,
W84-00985 2J

Quadratic Spline Subroutine Package,
W84-00993 2A

COMPUTERS
Distributed Control Systems for Desalination, W84-00717 3A

CONDUCTIVITY
Water Quality of the Upper Vermilion River, Louisiana, April-August 1980, W84-01046 5B

CONFINED AQUIFER
Land Subsidence in the San Joaquin Valley, California, as of 1980, W84-00932 4B

CONFINED AQUIFERS
Digital Model Evaluation of the Predevelopment Flow System of the Tertiary Limestone Aquifer, Southeast Georgia, Northeast Florida, and Southern South Carolina, W84-00779 2F

Ground-Water Conditions in the Eastern Part of Michaud Flats, Fort Hall Indian Reservation, Idaho, W84-00879 2F

CONFINED GROUNDWATER
Geohydrology of the Fresh-Water Aquifer System in the Vicinity of Ocean City, Maryland, W84-01011 2F

CONJUNCTIVE USE
An Engineering Economic Analysis of Artificial Recharge in a Conjunctive Irrigation Plan in the Columbia Basin Project, Washington, W84-00989 4B

CONNECTICUT
Report on Review of Water Supply Planning, Recommendations and Strategy for Western Connecticut. W84-00911 6B

Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport, W84-00999 5B

CONNECTICUT RIVER
Drainage Divides, Massachusetts--Connecticut River Lowlands and Chicopee River Basin, W84-00902 7C

CONNECTICUT RIVER BASIN
Historic and Prehistoric Patterns of Water Use in the Connecticut River Valley: Implications for Water Resources Planning, W84-00968 6D

CONSERVATION
Evaluating the Effectiveness of Promoting Residential Water Conservation through Exhibits, W84-00963 3D

CONSTRUCTION COSTS
Wanaque South Project Economic Feasibility Study, Executive Summary. W84-00789 6B

CONSUMPTIVE USE
Estimated Water Use in Missouri, 1980, W84-00894 7C

Consumptive Use of Freshwater in Florida, 1980, W84-00898 7C

CONTROL SYSTEMS
Distributed Control Systems for Desalination, W84-00717 3A

COOPERATIVE FUNDING AGREEMENTS
Activities in Idaho, Status of Projects, Fiscal Years 1982-83. W84-00835 9D

COSTS
Membrane Life, Capacity and Costs, W84-00711 3A

System Options and Costs in Dairy Ultrafiltration, W84-00712 3A

CRUORIN
Ultrafiltration of Effluents from Slaughterhouses and Brine in the Meat Industry, W84-00705 3A

CURVE FITTING
Quadratic Spline Subroutine Package, W84-00993 2A

CYCLING NUTRIENTS
Computer Simulation of Phosphorus Cycling in the Sediment-Water System of Eutrophic Lakes, W84-00964 2H

DAILY HYDROGRAPHS
Statistical Summaries of New Jersey Streamflow Records, W84-00800 7C

DAM CONSTRUCTION
State Water Plan: Subbasin 6, Lower Central Susquehanna River. W84-00847 6D

State Water Plan: Subbasin 4, Upper Susquehanna River. W84-00849 6B

DAMS
Water, Watts, and Wilds: Hydropower and Competing Uses in New England. W84-00914 6D

DATA ACQUISITION
Statistical Summaries of New Jersey Streamflow Records, W84-00800 7C

DATA BASE MANAGEMENT SYSTEMS
Definitions of Components of the Master Water Data Index Maintained by the National Water Data Exchange, W84-00778 10A

Definitions of Components of the Water Data Sources Directory Maintained by the National Water Data Exchange, W84-00815 10D

DATA COLLECTION
Evaluation of the Stream-flow Data in Pennsylvania, W84-00809 7A

Long Range Plans for Hydrologic Investigations, W84-00852 6B

Hydrocarbon Fuels in Ground Water--Increased Awareness and Concern in New Mexico, W84-00854 5B

Rainfall-Runoff Data From Small Watersheds in Colorado, October 1977 Through September 1980, W84-00858 7C

Water-Resources Investigations of the U. S. Geological Survey in Missouri, Fiscal Year 1983, W84-00862 7C

Selective Annotated Bibliography of Ground-Water Resources, Records of Wells and Springs, and Availability of Streamflow Data on Indian Reservations in Montana, W84-00863 7C

Water-Quality Data for the American River Basin, California, February-October 1979, W84-00938 7C

Drainage Areas of the Kanawha River Basin, W84-00948 7C

Water Resources Data for Puerto Rico, 1981-82, W84-01044 7C

DATA COLLECTIONS
Water Quality of the Barataria Marsh Unit, Jean Lafitte National Historic Park, Louisiana (April 1981-March 1982), W84-00900 7C

Reconnaissance of Ground-Water Quality, Eastern Snake River Basin, Idaho, W84-00974 2F

Water Resources Data, North Carolina, Water Year 1982, W84-01028 7C

DATA STORAGE AND RETRIEVAL
Directory of Assistance Centers of the National Water Data Exchange (NAWDEX), W84-00814 10D

Definitions of Components of the Water Data Sources Directory Maintained by the National Water Data Exchange, W84-00815 10D

Directory of Member Organizations of the Naitonal Water Data Exchange (NAWDEX), W84-00816 10D

Indentification Codes for Organizations Listed in Computerized Data Systems of the U.S. Geological Survey, W84-00817 10D

DEGRADATION
Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming, Part IV. Bed Elevations, 1980, W84-00936 7C

DELAWARE RIVER
Drainage Areas in New Jersey: Delaware River Basin and Streams Tributary to Delaware Bay, W84-00904 7C

Report of the River Master of the Delaware River for the Period December 1, 1980-November 30, 1981, W84-01040 3D

DENITRIFICATION
Nitrate Loss from Agricultural Drainage Waters: Implications for Nonpoint Source Control, W84-00965 5B

DESALINATION
Membrane Processes for Water, Pulp and Paper, Food. State of the Art, W84-00702 3A

Membrane Processes for Water Supply and Reuse - A Question of Energy Consumption and Cost, W84-00713 3A

Distributed Control Systems for Desalination, W84-00717 3A

Today's Status of pH Measurement and Control in Desalination Plants, W84-00718 3A

Instrumentation Problems in Libyn Desalination Plants, W84-00719 3A

Control and Instrumentation Experience at Lok on Pai Msf Seawater Desalination Plant, W84-00720 3A

An Introduction to New Energy Sources for Desalination, W84-00721 3A

DESALINATION

An Assessment of the Market Potential for Small Solar Powered Desalination Plants,
W84-00722 3A

Test Results from a Solar Boiler for Saline Water Distillation,
W84-00724 3A

Solar Distillation: The Solar-Driven Case,
W84-00726 3A

Comparison of Solar RO and Solar Thermal Desalination Systems,
W84-00727 3A

Design and Operation Experience with Solar Powered Multistage Desalination Plants,
W84-00728 3A

Solar Desalination: Prototype 'Pithon' A Special Solar Multiple-Effect Distiller,
W84-00729 3A

Waste Heat Powered Reverse Osmosis Plants,
W84-00731 3A

Usability of Low Temperature Waste Heat for Sea Water Desalination,
W84-00732 3A

Ocean Thermal Energy and Desalination,
W84-00733 3A

Development of Solar Desal, A Code for Modeling, Simulation and Design of Solar Desalination Systems,
W84-00734 3A

Engineering Design of a 6000 cu m/Day Seawater Hybrid RO-ED Helio-Desalting,
W84-00735 3A

Development of a Marine Osmotic Solar Still for a Sea Water Desalination,
W84-00736 3A

Solar Power/Desalination, PV ED System,
W84-00737 3A

Reliability of the Jeddah Seawater RO Desalination Plant Based Upon Operations Experience,
W84-00738 3A

Operational Experience of 2 x 11,500 m super 3 d Msf Seawater Desalination Plant,
W84-00741 3A

Experience in Commissioning Large Desalination Plants in the Middle East,
W84-00742 3A

The Riyadh Water Transmission System (RWTS),
W84-00743 3A

Development of Environmental Standards for Combined Desalination/Power Generating Stations in the Arabian Gulf Region,
W84-00744 3A

Experiments with Desalination of Arabian Gulf Water,
W84-00745 3A

Heat Transfer and Fluid Flow Characteristics in Flash Desalination Units,
W84-00746 3A

Closed Cycle Textile Dyeing:Full Scale Renovation of Hot Wash Water by Hyperfiltration,
W84-00749 3A

Virgin Islands Water and Power Authority (VIWAPA) Horizontal Tube, Falling Film, Low Temperature 1.25 MGD Multi-Effect Distillation Dual Purpose Plant,
W84-00750 3A

The Caribbean, the other Area of Concentration of Desalination Plants,
W84-00751 3A

Desalination in Mexico,
W84-00752 3A

Reducing and Monitoring Corrosion in MSF Evaporators in the Change-Over From Acid Treatment to Treatment with Additives,
W84-00753 3A

Studies, Testing and Development of a Line of Brine Recirculating Pumps for Sea Water Desalination Installations,
W84-00754 3A

Desalination and Renewable Energies - A Few Recent Developments,
W84-00755 3A

Combined MSF/VTE-Modules for Hybrid Thermal Seawater Desalination Plants,
W84-00756 3A

Activities in Spain,
W84-00757 3A

Desalination in Australia - Past and Future,
W84-00758 3A

Operating Experience on Ro Sea Water Desalination Plant at Chigasaki Laboratory,
W84-00759 3A

Optimization of Integrated Cogeneration Power Plant and Desalination Plant Systems for a Range of Power and Water Supply Requirements,
W84-00761 3A

The Application of Pelton Type Impulse Turbines for Energy Recovery on Sea Water Reverse Osmosis Systems,
W84-00762 3A

An Integrated Self Sufficient Multipurpose Plant for Seawater Desalination,
W84-00763 3A

Education and Training in Desalination Around the World,
W84-00764 3A

A Tailored Process for Remineralization and Potabilization of Desalinated Water,
W84-00768 3A

DESALINATION PLANTS

Performance Evaluation of MSF Plants, the Case of Jeddah Plants,
W84-00739 3A

Performance Study of Water Desalination Methods in Saudi Arabia,
W84-00740 3A

A New Idea for Training Operators,
W84-00765 3A

Handling of Fuzzy Decisions in the Engineering Management of Large Desalination Plants,
W84-00766 3A

DESIGN FLOOD

Estimating Peak Discharges of Small Rural Streams in Massachusetts,
W84-00990 2E

DESIGN HYDROGRAPHS

Techniques for Estimating Flood Hydrographs for Ungaged Urban Watersheds,
W84-00940 2E

DESTRATIFICATION

Localized Destratification at Lake Texoma,
W84-00956 5G

DEWATERING

The Puerco River: Muddy Issues Raised by a Mine Water Dominated Ephemeral Stream,
W84-00853 5B

Premining Hydrology of the Lignite Area in Southeastern De Soto Parish, Louisiana,
W84-01006 4C

DIAGENESIS

Computer Simulation of Phosphorus Cycling in the Sediment-Water System of Eutrophic Lakes,
W84-00964 2H

DIRECTORIES

Directory of Member Organizations of the Naitonal Water Data Exchange (NAWDEX),
W84-00816 10D

DISCHARGE

Potential Hydrologic Impacts of Ground-Water Withdrawals from the Cape Cod National Seashore, Truro, Massachusetts,
W84-00944 2F

DISCHARGE MEASUREMENT

Discharge Data at Water-Quality Monitoring Stations in Arkansas, 1980 Water Year,
W84-00887 7C

Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge,
W84-01048 7B

Measurement and Computation of Streamflow: Volume 2. Computation of Discharge,
W84-01049 2E

DISCHARGE (WATER)

Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge,
W84-01048 7B

Measurement and Computation of Streamflow: Volume 2. Computation of Discharge,
W84-01049 2E

DISPERSION

Time of Travel of Selected Arkansas Streams,
W84-00895 2E

DISSOLVED OXYGEN

Subbasins 14 and 16, Genesee River and Upper Allegheny River,
W84-00838 6B

Water Quality of the Upper Vermilion River, Louisiana, April-August 1980,
W84-01046 5B

DISTILLATION

Control and Instrumentation Experience at Lok on Pai Msf Seawater Desalination Plant,
W84-00720 3A

Virgin Islands Water and Power Authority (VIWAPA) Horizontal Tube, Falling Film, Low Temperature 1.25 MGD Multi-Effect Distillation Dual Purpose Plant,
W84-00750 3A

DISTRIBUTION

Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport,
W84-00999 5B

DISTRIBUTION PATTERNS

Wetland Hydrology and Tree Distribution of the Apalachicola River Flood Plain, Florida,
W84-00813 2I

DIVERSION RELEASE

Report of the River Master of the Delaware River for the Period December 1, 1980-November 30, 1981,
W84-01040 3D

DOMESTIC WATER CONSERVATION
Evaluating the Effectiveness of Promoting Residential Water Conservation through Exhibits, W84-00963 3D

DRAINAGE AREA
Drainage Areas in New Jersey: Delaware River Basin and Streams Tributary to Delaware Bay, W84-00904 7C

Drainage Areas of the Kanawha River Basin, W84-00948 7C

DRAINAGE BASINS
Drainage Divides, Massachusetts--Nashua and Concord River Basins, W84-00822 7C

Drainage Divides, Massachusetts--Taunton River Basin and Southeast Coastal Basins, W84-00868 7C

Drainage Divides, Massachusetts--Connecticut River Lowlands and Chicopee River Basin, W84-00902 7C

DRAINAGE EFFECTS
Nitrate Loss from Agricultural Drainage Waters: Implications for Nonpoint Source Control, W84-00965 5B

DRAINAGE WELLS
Geohydrologic Reconnaissance of Drainage Wells in Florida--An Interim Report, W84-00865 4B

DRILLING
Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area, W84-00783 2F

DRINKING WATER
Advance in Water Quality Monitoring and the Use of Firefly Luciferine/Luciferase Atp Bioassay, W84-00769 5D

DROUGHT
Legal Aspects of Stored Water in Federal Reservoirs in Kansas, W84-00971 6E

Report of the River Master of the Delaware River for the Period December 1, 1980-November 30, 1981, W84-01040 3D

DUAL PURPOSE PLANTS
Virgin Islands Water and Power Authority (VIWAPA) Horizontal Tube, Falling Film, Low Temperature 1.25 MGD Multi-Effect Distillation Dual Purpose Plant, W84-00750 3A

DURATION TABLE
Selected Flow Characteristics of Florida Streams and Canals, W84-01012 7C

DYES
Closed Cycle Textile Dyeing:Full Scale Renovation of Hot Wash Water by Hyperfiltration, W84-00749 3A

Removal of Refractory Organics from Water by Aeration. II. Solvent Sublation of Methylene Blue and Methyl Orange, W84-00954 5F

ECONOMIC ASPECTS
Municipal Wastewater Treatment: 1970 and Today, W84-00918 5G

ECONOMIC EVALUATION
Optimization of Integrated Cogeneration Power Plant and Desalination Plant Systems for a Range of Power and Water Supply Requirements, W84-00761 3A

ECONOMIC FEASIBILITY
Wanaque South Project Economic Feasibility Study, Executive Summary. W84-00789 6B

ECONOMICS
Membrane Technology and Costs; State of the Art, W84-00710 3A

EDUCATION
Education and Training in Desalination Around the World, W84-00764 3A

Evaluating the Effectiveness of Promoting Residential Water Conservation through Exhibits, W84-00963 3D

EFFLUENTS
Graphical Method for Estimating Occurrence and Duration of a Critical Low Flow in the Sacramento River at Freeport, California, W84-00973 5G

ELECTRIC POWER COSTS
Water, Watts, and Wilds: Hydropower and Competing Uses in New England. W84-00914 6D

ELECTRIC POWER DEMAND
State Water Plan: Subbasin 7, Lower Susquehanna River. W84-00846 6B

State Water Plan: Subbasin 6, Lower Central Susquehanna River. W84-00847 6D

ELECTRIC POWER PRODUCTION
Water, Watts, and Wilds: Hydropower and Competing Uses in New England. W84-00914 6D

Annapolis Points the Way for Fundy, W84-00972 8A

ELECTRICAL EQUIPMENT
Water, Watts, and Wilds: Hydropower and Competing Uses in New England. W84-00914 6D

ELECTRODIALYSIS
Application of Selective Membranes in Grape Juice Stabilization, W84-00706 3A

Solar Power/Desalination, PV ED System, W84-00737 3A

ENERGY
Preconcentration by Reverse Osmosis Before Evaporation - Possibilities in Sweden, W84-00714 3A

ENERGY CONVERSION
Ocean Thermal Energy and Desalination, W84-00733 3A

ENERGY SOURCES
An Introduction to New Energy Sources for Desalination, W84-00721 3A

ENVIRONMENTAL EFFECTS
Development of Environmental Standards for Combined Desalination/Power Generating Stations in the Arabian Gulf Region, W84-00744 3A

Procedures for Assessment of Cumulative Impacts of Coal Mining on the Hydrologic Balance, W84-00780 4C

Hydrologic Monitoring in the Area of the Proposed Yazoo River Navigation Project, West Central Mississippi, 1978-80, W84-00942 7C

ENZYMES
Biocatalysis by Membrane-Attached Enzymes and Whole Microbial Cells, W84-00708 3A

EPHEMERAL STREAMS
The Puerco River: Muddy Issues Raised by a Mine Water Dominated Ephemeral Stream, W84-00853 5B

ESTIMATED WATER USE
Estimated Water Use in Southwest Florida, 1981, and Summary of Annual Water Use, 1970, 1975, and 1977-81, W84-00892 7C

ESTUARY
Literature Assessment of the Charlotte Harbor Estuarine System and Surrounding Area, Southwest Florida, W84-00992 10C

EUTROPHIC LAKES
Subbasin 15, Lake Erie, W84-00840 6B

EVAPOTRANSPIRATION
A Hydrologic Analysis of the New Jersey Pine Barrens Region, W84-00781 2A

Ground Water Quality in the South of Albuquerque, W84-00856 5B

EXHIBITS
Evaluating the Effectiveness of Promoting Residential Water Conservation through Exhibits, W84-00963 3D

EXTENSOMETERS
Land Subsidence in the San Joaquin Valley, California, as of 1980, W84-00932 4B

FEASIBILITY STUDIES
Wanaque South Project Economic Feasibility Study, Executive Summary. W84-00789 6B

FEDERAL JURISDICTION
Municipal Wastewater Treatment: 1970 and Today, W84-00918 5G

FEDERAL NONRESERVED RIGHTS
Legal Aspects of Stored Water in Federal Reservoirs in Kansas, W84-00971 6E

FEDERAL PROGRAM
Funding History of the U.S. Geological Survey Federal Data Collection and Analysis Program, W84-00836 9D

FILTRATION
Removing Uranium From Drinking Water Supplies: Demonstration of Selected Ion Exchange and Chemical Clarification, W84-00857 5F

FINDEX
Revised Description of Index of Florida Water Data Collection Active Stations and a User's Guide for Station or Site Information Retrieval Computer Program Findex H578, W84-00885 10D

FINITE-DIFFERENCE METHODS
Modifications and Corrections to the Finite Difference Model for Simulation of Three-Dimensional Ground-Water Flow, W84-00776 2F

FINITE-DIFFERENCE METHODS

Mathematical Models of Soil Moisture Profiles Using Two-Phase Flow Theory,
W84-00966 2G

FINITE-DIFFERENCE MODEL
A Three-Dimensional Ground-Water-Flow Model Modified to Reduce Computer-Memory Requirements and Better Simulate Confining-Bed and Aquifer Pinchouts,
W84-00775 2F

FINITE ELEMENT ANALYSIS
A Two-Dimensional Finite-Element Model Study of Backwater and Flow Distribution at the I-10 Crossing of the Pearl River Near Slidell, Louisiana,
W84-00896 2A

FLASH DISTILLATION
Heat Transfer and Fluid Flow Characteristics in Flash Desalination Units,
W84-00746 3A

FLOOD CONTROL
State Water Plan: Subbasin 7, Lower Susquehanna River.
W84-00846 6B

State Water Plan: Subbasin 6, Lower Central Susquehanna River.
W84-00847 6D

State Water Plan: Subbasin 5, Upper Central Susquehanna River.
W84-00848 6B

State Water Plan: Subbasin 1, Upper Delaware River.
W84-00850 6B

FLOOD DAMAGE
The State Water Plan, Subbasin 18, Lower Allegheny River.
W84-00786 5B

Floods of November 1978 to March 1979 in Arizona and West-Central New Mexico,
W84-00837 7C

State Water Plan: Subbasin 9, Central West Branch Susquehanna River.
W84-00844 6B

Floods of October 1977 in Southern Arizona and March 1978 in Central Arizona,
W84-00953 2E

FLOOD DATA
Flood of June 13-15, 1981, in the Blanchard River Basin, Northwestern Ohio,
W84-00777 7C

Floods of December 1982 and January 1983 in Central and Southern Mississippi River Basin,
W84-00886 7C

FLOOD FREQUENCY
Subbasin 11, Upper Juniata River,
W84-00839 6B

Subbasin 12, Lower Juniata River.
W84-00842 6D

Magnitude and Frequency of Flooding on Small Urban Watersheds in the Tampa Bay Area, West-Central Florida,
W84-00994 2A

FLOOD HYDROGRAPHS
Techniques for Estimating Flood Hydrographs for Ungaged Urban Watersheds,
W84-00940 2E

FLOOD HYDROLOGY
Annual Snowmelt and Rainfall Peak-Flow Data on Selected Foothills Region Streams, South Platte River Arkansas River, and Colorado River Basins, Colorado,
W84-01038 7C

FLOOD PLAIN MANAGEMENT
State Water Plan: Subbasin 7, Lower Susquehanna River.
W84-00846 6B

FLOOD PLAINS
Wetland Hydrology and Tree Distribution of the Apalachicola River Flood Plain, Florida,
W84-00813 2I

A Two-Dimensional Finite-Element Model Study of Backwater and Flow Distribution at the I-10 Crossing of the Pearl River Near Slidell, Louisiana,
W84-00896 2A

FLOOD PROFILES
Flood of June 13-15, 1981, in the Blanchard River Basin, Northwestern Ohio,
W84-00777 7C

Cane Creek Flood-Flow Characteristics at State Route 30 Near Spencer, Tennessee,
W84-00871 4C

Flood Profiles in the Calapooya Creek Basin, Oregon,
W84-01021 7C

FLOOD PROTECTION
State Water Plan: Subbasin 7, Lower Susquehanna River.
W84-00846 6B

State Water Plan: Subbasin 6, Lower Central Susquehanna River.
W84-00847 6D

State Water Plan: Subbasin 5, Upper Central Susquehanna River.
W84-00848 6B

State Water Plan: Subbasin 1, Upper Delaware River.
W84-00850 6B

FLOODING
Changes in Flood Response of the Red River of the North Basin, North Dakota-Minnesota,
W84-01020 4C

FLOODS
Effects of Urbanization on the Magnitude and Frequency of Floods on Small Streams in Tennessee-Basic Data Report No. 2,
W84-00826 4C

Floods of November 1978 to March 1979 in Arizona and West-Central New Mexico,
W84-00837 7C

Cane Creek Flood-Flow Characteristics at State Route 30 Near Spencer, Tennessee,
W84-00871 4C

Floods of December 1982 and January 1983 in Central and Southern Mississippi River Basin,
W84-00886 7C

A Two-Dimensional Finite-Element Model Study of Backwater and Flow Distribution at the I-10 Crossing of the Pearl River Near Slidell, Louisiana,
W84-00896 2A

Techniques for Estimating Flood Hydrographs for Ungaged Urban Watersheds,
W84-00940 2E

Floods of October 1977 in Southern Arizona and March 1978 in Central Arizona,
W84-00953 2E

Flood Profiles in the Calapooya Creek Basin, Oregon,
W84-01021 7C

Small-Stream Flood Investigations in Minnesota, October 1958 to September 1980,
W84-01033 7C

FLOODWAY
Flood Profiles in the Calapooya Creek Basin, Oregon,
W84-01021 7C

FLORIDA
Semiannual Water-Level and Potentiometric Contours of Two Water-Yielding Zones in the Surficial Aquifer, 1975-79, Naples, Florida,
W84-00803 7C

Chemical Quality of Water in the Upper Part of the Floridian Aquifer, Duval County, Florida,
W84-00806 7C

The Benchmark Farm Program-- A Method for Estimating Irrigation Water Use in Southwest Florida,
W84-00808 7C

Wetland Hydrology and Tree Distribution of the Apalachicola River Flood Plain, Florida,
W84-00813 2I

Potentiometric Surface of the Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida, May 1982,
W84-00819 7C

Geohydrologic Reconnaissance of Drainage Wells in Florida--An Interim Report,
W84-00865 4B

Ground-Water Levels in Selected Well Fields and in West-Central Florida, May 1982,
W84-00867 7C

Water-Quality Reconnaisance of the North Data County Solid-Waste Disposal Facility, Florida,
W84-00874 5B

Estimated Water Use in Southwest Florida, 1981, and Summary of Annual Water Use, 1970, 1975, and 1977-81,
W84-00892 7C

Consumptive Use of Freshwater in Florida, 1980,
W84-00898 7C

Hydrology of the Hamilton Lakes and Vicinity, Polk County, Central Florida,
W84-00905 7C

Continuous Seismic-Reflection Survey Defining Shallow Sedimentary Layers in the Charlotte Harbor and Venice Areas, Southwest, Florida,
W84-00929 2F

Hydrologic Data From Monitoring of Saline-Water Intrusion in the Cape Coral Area, Lee County, Florida,
W84-00935 7C

Index of Hydrologic Data for Selected Sites in Broward County, Florida, 1939-80,
W84-00943 7C

Records of Selected Wells and Lithologic Logs of Test Holes, Hendry County and Adjacent Areas, Florida,
W84-00945 7C

Data on Subsurface Storage of Liquid Waste Near Pensacola, Florida, 1963-1980,
W84-00951 7C

Appraisal of the Interconnection between the St. Johns River and the Surficial Aquifer, East Central Duval County, Florida,
W84-00975 6G

Geohydrology of the Floridan Aquifer in the Withlacoochee River Basin of the Southwest Florida Water Management District,
W84-00984 7C

Occurrence and Use of Ground Water in the Venice-Englewood Area, Sarasota and Charlotte Counties, Florida,
W84-00987 6D

Literature Assessment of the Charlotte Harbor Estuarine System and Surrounding Area, Southwest Florida,
W84-00992 10C

Magnitude and Frequency of Flooding on Small Urban Watersheds in the Tampa Bay Area, West-Central Florida,
W84-00994 2A

Hydrogeology of a Landfill Operation, Pinellas County, Florida,
W84-00996 5B

Principal Aquifers in Florida,
W84-01004 7C

Potentiometric Surface of the Floridan Aquifer in Florida, May 1980,
W84-01005 7C

Selected Flow Characteristics of Florida Streams and Canals,
W84-01012 7C

Water Resources of the Santa Fe River Basin, Florida,
W84-01013 2F

Assessment of the Interconnection Between Tampa Bay and the Floridan Aquifer, Florida,
W84-01019 2F

Water Resources of Manatee County Florida,
W84-01026 2F

Generalized Configuration of the Top of the Limestone Unit of the Lower Part of the Surficial Aquifer, Duval County, Florida,
W84-01037 7C

FLORIDAN AQUIFER

Predevelopment Flow in the Tertiary Limestone Aquifer, Southeastern United States: A Regional Analysis From Digital Modeling,
W84-00884 2F

FLOW CHARACTERISTICS

Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

FLOW RATES

Time of Travel of Selected Arkansas Streams,
W84-00895 2E

FLOW VARIABILITY

Monthly Low-Flow Characteristics of Georgia Streams,
W84-00923 7C

FOOD INDUSTRY

Membrane Processes for Water, Pulp and Paper, Food. State of the Art,
W84-00702 3A

FORECASTING

Historic and Prehistoric Patterns of Water Use in the Connecticut River Valley: Implications for Water Resources Planning,
W84-00968 6D

FRACTURE PERMEABILITY

Geology and Ground-Water Resources of the Rahway Area, New Jersey,
W84-00796 2F

FREQUENCY ANALYSIS

Estimating Peak Discharges of Small Rural Streams in Massachusetts,
W84-00990 2E

GAGING STATIONS

An Evaluation of Idaho Stream-Gaging Networks,
W84-00866 7A

GAS CHROMATOGRAPHY

Analysis of Water Samples for Toxic Volatile Organic Compounds: State of the Art Methods and Strategies for Sampling,
W84-00851 5A

Specific Identification of Organic Pollutants in Haw River Water Using Gas Chromatography/Mass Spectrometry,
W84-00959 5A

GEOHYDROLOGIC UNITS

Ground Water-Surface Water Relationships in the Bonaparte Creek Basin, Okanogan County, Washington 1979-80,
W84-01017 2A

GEOHYDROLOGY

Geology and Ground Water Resources of Hunterdon County, New Jersey,
W84-00791 2F

Hydrogeology and Simulation Model of Water Flow in the Kootenai Aquifer of the Judith Basin, Central Montana,
W84-01009 2F

Numerical Simulation of Ground-Water Flow in the Lower Satus Creek Basin, Yakima Indian Reservation, Washington,
W84-01010 4B

GEOLOGIC CONTROL

Geohydrologic Reconnaissance of Lake Mead National Recreation Area--Las Vegas Wash to Opal Mountain, Nevada,
W84-00934 2F

GEOLOGIC FORMATIONS

Water Resources Resume: State Atlas Sheet No. 23, Parts of Bergen, Morris and Passaic Counties,
W84-00792 7C

GEOMORPHOLOGY

Hydrogeologic Features of the Alluvial Deposits in the Owl Creek Valley, Bighorn Basin, Wyoming,
W84-00770 2F

Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming: Part III. River Hydraulics and Sediment Transport, 1980,
W84-00937 7C

GEOPHYSICAL PROSPECTING

Geothermal Resources of the Western Arm of the Black Rock Desert, Northwestern Nevada--Part I, Geology and Geophysics,
W84-01007 2F

GEOPHYSICS

Continuous Seismic-Reflection Survey Defining Shallow Sedimentary Layers in the Charlotte Harbor and Venice Areas, Southwest, Florida,
W84-00929 2F

GEORGIA

Monthly Low-Flow Characteristics of Georgia Streams,
W84-00923 7C

Ground-Water Data for Georgia, 1981,
W84-00986 7C

Hydrogeology of the Providence Aquifer of Southwest Georgia,
W84-01031 2F

GEOTHERMAL STUDIES

Geothermal Resources of the Western Arm of the Black Rock Desert, Northwestern Nevada--Part I, Geology and Geophysics,
W84-01007 2F

GILA RIVER

Floods of November 1978 to March 1979 in Arizona and West-Central New Mexico,
W84-00837 7C

GLACIAL DRIFT

Water Information for Northwestern Missouri--A Planning Document,
W84-00810 3B

GRAPE JUICE

Application of Selective Membranes in Grape Juice Stabilization,
W84-00706 3A

GRAVIMETRIC PROSPECTING

Gravity Survey of Dixie Valley, West-Central Nevada,
W84-01000 2F

GRAVITY LYSIMETERS

Hydraulic Considerations in Sampling the Unsaturated Zone with Inclined Gravity Lysimeters,
W84-01018 2G

GREAT BASIN

Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan,
W84-01008 2F

GROUND WATER

Ground-Water Resources of Ransom and Sargent Counties, North Dakota,
W84-01050 2F

GROUNDWATER

Ground Water Resources in Fayoum Area, Egypt,
W84-00747 3A

Origin of Subsurface Water in Khartoum Province, Sudan,
W84-00748 3A

Hydrogeologic Features of the Alluvial Deposits in the Owl Creek Valley, Bighorn Basin, Wyoming,
W84-00770 2F

Effect of Urbanization on the Water Resources of Warminster Township, Bucks County, Pennsylvania,
W84-00774 5B

A Hydrologic Analysis of the New Jersey Pine Barrens Region,
W84-00781 2A

Saturated Thickness of the High Plains Regional Aquifer in 1980, Northwestern Oklahoma,
W84-00804 7C

Chemical Quality of Water in the Upper Part of the Floridian Aquifer, Duval County, Florida,
W84-00806 7C

Map Showing Groundwater Conditions in the Tonto Basin Area, Gila County, Arizona--1979,
W84-00807 7C

Map of the Antelope Valley-East Kern Water Agency Area, California, Showing Groundwater Subunits and Areas, and Well Hydrographs, 1962 to 1982,
W84-00820 7C

GROUNDWATER

Annual Summary of Ground-Water Conditions in Arizona, Spring 1981 to Spring 1982,
W84-00824 7C

Hydrographs of Water Levels in Observation Wells in Idaho, 1971-82,
W84-00831 7C

Compilation of Ground-Water Quality Data for Selected Wells in Elmore, Owyhee, Ada, and Canyon Counties, Idaho, 1945 through 1982,
W84-00834 7C

Long Range Plans for Hydrologic Investigations,
W84-00852 6B

Selective Annotated Bibliography of Ground-Water Resources, Records of Wells and Springs, and Availability of Streamflow Data on Indian Reservations in Montana,
W84-00863 7C

Statistical Summaries of Selected Chemical Constituents in Kansas Ground-Water Supplies,
W84-00869 2F

Annual Water-Resources Review, white Sands Missile Range, New Mexico, 1981,
W84-00872 2F

Ground-Water Data for Michigan, 1981,
W84-00875 7C

Potentiometric-Surface Map of Water in the Judith River Formation in the Northern Great Plains Area of Montana,
W84-00877 7C

Ground-Water Conditions in the Eastern Part of Michaud Flats, Fort Hall Indian Reservation, Idaho,
W84-00879 2F

Ground Water for Public Supply at Windigo, Isle Royale National Park, Michigan,
W84-00880 2F

Potentiometric-Surface Map of Water in the Lakota Formation and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00881 7C

Potentiometric-Surface Map of Water in the Fox Hills Lower Hell Creek Aquifer in the Northern Great Plains are of Montana,
W84-00903 7C

Water-Level Maps of the Alluvial Aquifer, Northwestern Mississippi September 1981,
W84-00921 7C

Approximate Altitude of Water Levels in Wells in the Chicot and Evangeline Aquifers in the Houston Area, Texas, Spring 1982,
W84-00922 7C

Ground Water and Geology of Marquette County, Michigan,
W84-00925 2F

Water Quality of Coal Deposits and Abandoned Mines, Saginaw County, Michigan,
W84-00926 7C

Data for Ground-Water Test Hole near Zamora, Central Valley Aquifer Project, California,
W84-00927 7C

Land Subsidence in the San Joaquin Valley, California, as of 1980,
W84-00932 4B

Geohydrologic Reconnaissance of Lake Mead National Recreation Area--Las Vegas Wash to Opal Mountain, Nevada,
W84-00934 2F

Annual Summary of Ground-Water Conditions in Arizona, Spring 1980 to Spring 1981.
W84-00941 7C

Potential Hydrologic Impacts of Ground-Water Withdrawals from the Cape Cod National Seashore, Truro, Massachusetts,
W84-00944 2F

Hydrologic Data for the Pelican River Sands Aquifer, Western Minnesota,
W84-00947 7C

Potentiometric-Surface Map of Water in the Eagle Sandstone and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00949 7C

Ground-Water Levels in Wyoming, 1971 Through Part of 1980,
W84-00950 7C

Reconnaissance of Ground-Water Quality, Eastern Snake River Basin, Idaho,
W84-00974 2F

Hydrologic Effects of Storing Liquified Sewage Sludge on Strip-Mined Land in Fulton County, Illinois,
W84-00977 5E

Major Aquifers in Hanson and Davison Counties, South Dakota,
W84-00978 2F

Major Aquifers in Yankton County, South Dakota,
W84-00979 2F

January 1982 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W84-00981 7C

Atlas of Eleven Selected Aquifers in New York,
W84-00983 7C

Geohydrology of the Floridan Aquifer in the Withlacoochee River Basin of the Southwest Florida Water Management District,
W84-00984 7C

Ground-Water Data for Georgia, 1981,
W84-00986 7C

Evaluation of Water-Quality Characteristics of Part of the Spokane Aquifer, Washington and Idaho, Using a Solute-Transport Digital Model,
W84-01001 2F

Geohydrology of the High Plains Aquifer System in Nebraska,
W84-01002 7C

Principal Aquifers in Florida,
W84-01004 7C

Potentiometric Surface of the Floridan Aquifer in Florida, May 1980,
W84-01005 7C

Hydrogeology and Simulation Model of Water Flow in the Kootenai Aquifer of the Judith Basin, Central Montana,
W84-01009 2F

Numerical Simulation of Ground-Water Flow in the Lower Satus Creek Basin, Yakima Indian Reservation, Washington,
W84-01010 4B

Ground Water-Surface Water Relationships in the Bonaparte Creek Basin, Okanogan County, Washington 1979-80,
W84-01017 2A

Evaluation of the Hydrologic System in the New Leipzig Coal Area, Grant and Hettinger Counties, North Dakota,
W84-01022 2F

Water Resources Data, North Carolina, Water Year 1982,
W84-01028 7C

Effects of Ground-Water Development in the North Fort Hood Area, Coryell County, Texas,
W84-01032 2F

Hydrology of Area 49, Northern Great Plains and Rocky Mountain Coal Provinces, Montana and Wyoming,
W84-01043 2A

Water Resources Data for Puerto Rico, 1981-82,
W84-01044 7C

GROUNDWATER AVAILABILITY

Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area,
W84-00783 2F

Geology and Ground Water Resources of Hunterdon County, New Jersey,
W84-00791 2F

Water Resources Resume: State Atlas Sheet No. 23, Parts of Bergen, Morris and Passaic Counties,
W84-00792 7C

Geology and Ground-Water Resources of the Rahway Area, New Jersey,
W84-00796 2F

Water Resources and Geology of Gloucester County, New Jersey,
W84-00798 2F

Geology of the Ground Water Resources of Mercer County,
W84-00799 2F

Ground Water: A Non-Technical Guide,
W84-00915 2F

Occurrence and Use of Ground Water in the Venice-Englewood Area, Sarasota and Charlotte Counties, Florida,
W84-00987 6D

Hydrologic Analysis of the Upper San Pedro Basin from the Mexico-United States International Boundary to Fairbank, Arizona,
W84-01023 2A

GROUNDWATER BUDGET

Use of a Three-Dimensional Model for the Analysis of the Ground-Water Flow System in Parker Valley, Arizona and California,
W84-00823 2F

GROUNDWATER CONTAMINATION

Ground Water Quality in the South of Albuquerque,
W84-00856 5B

Groundwater Quality in New Jersey--An Investigation of Toxic Contaminants,
W84-00912 5B

GROUNDWATER DATA

Ground-Water Data from Selected Wells in Alluvial Aquifers, Powder River Basin, Northeastern Wyoming,
W84-00830 7C

GROUNDWATER DEPLETION

Ground-Water Resources of Essex County, New Jersey,
W84-00797 2F

Hydrographs of Water Levels in Observation Wells in Idaho, 1971-82,
W84-00831 7C

Water Resources of Borrego Valley and Vicinity, California, Phase 1--Definition of Geologic and Hydrologic Characteristics of Basin,
W84-00980 7C

GROUNDWATER DISCHARGE
Preliminary Survey of Ground-Water Resources for Island County, Washington,
W84-00878 2F

Hydrology of the Beryl-Enterprise Area, Escalante Desert, Utah, with Emphasis on Ground Water,
W84-01024 2F

GROUNDWATER FLOW
Model Modifications for Simulation of Flow Through Stratified Rocks in Eastern Ohio,
W84-00773 4C

A Three-Dimensional Ground-Water-Flow Model Modified to Reduce Computer-Memory Requirements and Better Simulate Confining-Bed and Aquifer Pinchouts,
W84-00775 2F

Modifications and Corrections to the Finite Difference Model for Simulation of Three-Dimensional Ground-Water Flow,
W84-00776 2F

Ground Water: A Non-Technical Guide,
W84-00915 2F

Analysis and Computer Simulation of Stream-Aquifer Hydrology, Arkansas River Valley, Southwestern Kansas,
W84-01016 2A

GROUNDWATER HYDROGRAPHS
Ground-Water Data for Michigan, 1981,
W84-00875 7C

GROUNDWATER LEVEL
Ground-Water Resources of Essex County, New Jersey,
W84-00797 2F

Ground-Water Levels in Arkansas, Spring 1982,
W84-00870 7C

Premining Hydrology of the Lignite Area in Southeastern De Soto Parish, Louisiana,
W84-01006 4C

GROUNDWATER LEVELS
Hydrologic Monitoring in the Area of the Proposed Yazoo River Navigation Project, West Central Mississippi, 1978-80,
W84-00942 7C

Ground-Water Data for Georgia, 1981,
W84-00986 7C

Trends in Ground-Water Levels in Wisconsin Through 1981,
W84-01047 7C

GROUNDWATER MANAGEMENT
Groundwater Management in the Southeast,
W84-00955 4B

GROUNDWATER MINING
Hydrology of the Beryl-Enterprise Area, Escalante Desert, Utah, with Emphasis on Ground Water,
W84-01024 2F

GROUNDWATER MOVEMENT
Digital Model Evaluation of the Predevelopment Flow System of the Tertiary Limestone Aquifer, Southeast Georgia, Northeast Florida, and Southern South Carolina,
W84-00779 2F

The State Water Plan, Subbasin 17, Central Allegheny River.
W84-00784 6D

Geology and Ground-Water Resources of Salem County, New Jersey,
W84-00795 2F

Geology and Ground-Water Resources of the Rahway Area, New Jersey,
W84-00796 2F

Ground-Water Resources of Essex County, New Jersey,
W84-00797 2F

Predevelopment Flow in the Tertiary Limestone Aquifer, Southeastern United States: A Regional Analysis From Digital Modeling,
W84-00884 2F

Ground-Water Resources of the White River Basin, Hamilton and Tipton Counties, Indiana,
W84-00930 2F

Ground-Water Resources of the White River Basin, Delaware County, Indiana, 1977,
W84-00931 2F

Hydrogeology of a Landfill Operation, Pinellas County, Florida,
W84-00996 5B

Geohydrology of the Fresh-Water Aquifer System in the Vicinity of Ocean City, Maryland,
W84-01011 2F

GROUNDWATER POLLUTION
Status of Ground Water Quality in Logan Township, Gloucester County,
W84-00782 5B

Iron in Ground Waters of the Magothy and Raritan Formations in Camden and Burlington Counties, New Jersey,
W84-00790 5B

Subbasin 11, Upper Juniata River,
W84-00839 6B

State Water Plan: Subbasin 9, Central West Branch Susquehanna River.
W84-00844 6B

Ground Water Quality in the South of Albuquerque,
W84-00856 5B

Geohydrologic Reconnaissance of Drainage Wells in Florida--An Interim Report,
W84-00865 4B

Groundwater Quality in New Jersey--An Investigation of Toxic Contaminants,
W84-00912 5B

GROUNDWATER POTENTIAL
The State Water Plan, Subbasin 17, Central Allegheny River.
W84-00784 6D

Geology and Ground-Water Resources of Salem County, New Jersey,
W84-00795 2F

Geology and Ground-Water Resources of the Rahway Area, New Jersey,
W84-00796 2F

Ground Water: A Non-Technical Guide,
W84-00915 2F

GROUNDWATER PUMPAGE
Water Use in Wisconsin, 1979,
W84-00928 7C

GROUNDWATER QUALITY
Occurrence and Use of Ground Water in the Venice-Englewood Area, Sarasota and Charlotte Counties, Florida,
W84-00987 6D

GROUNDWATER RECHARGE
Use of a Three-Dimensional Model for the Analysis of the Ground-Water Flow System in Parker Valley, Arizona and California,
W84-00823 2F

Ground Water: A Non-Technical Guide,
W84-00915 2F

Ground Water in the Seaside Area, Monterrey County, California,
W84-00991 2F

Impact of Changes in Land Use on the Ground-Water System in The Sequim-Dungeness Peninsula, Clallam County, Washington,
W84-01014 4C

Hydrology of the Beryl-Enterprise Area, Escalante Desert, Utah, with Emphasis on Ground Water,
W84-01024 2F

GROUNDWATER RESERVOIRS
Ground Water in the Seaside Area, Monterrey County, California,
W84-00991 2F

GROUNDWATER RESOURCES
Appraisal of Water From the Pelican River Sand-Plain Aquifer, West-Central Minnesota,
W84-00988 2F

Water Resources of the Santa Fe River Basin, Florida,
W84-01013 2F

Water Resources of Manatee County Florida,
W84-01026 2F

GROUNDWATER STORAGE
Water Resources of Borrego Valley and Vicinity, California, Phase 1--Definition of Geologic and Hydrologic Characteristics of Basin,
W84-00980 7C

GROUNDWATER WITHDRAWALS
Effects of Ground-Water Development in the North Fort Hood Area, Coryell County, Texas,
W84-01032 2F

GROUNDWATERS
Ground-Water Levels in Selected Well Fields and in West-Central Florida, May 1982,
W84-00867 7C

GUYANDOTTE RIVER BASIN
Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

HARBORS
Harbor Management Strategies for New England,
W84-00907 6B

HAZARDOUS MATERIALS
Hydrocarbon Fuels in Ground Water--Increased Awareness and Concern in New Mexico,
W84-00854 5B

Industrial Wastewater,
W84-00917 5G

HAZARDOUS WASTES
Analysis of Water Samples for Toxic Volatile Organic Compounds: State of the Art Methods and Strategies for Sampling,
W84-00851 5A

HEAVY METALS
Reconnaissance for Determining Effects of Land Use and Surficial Geology on Concentrations of

HEAVY METALS

Selected Elements on Streambed Materials from the Coal Mining, Region, Southwestern Indiana, October 1979 to March 1980,
W84-00771 5B

Ground-Water Conditions in the Eastern Part of Michaud Flats, Fort Hall Indian Reservation, Idaho,
W84-00879 2F

Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey: 1981 Annual Report,
W84-00897 5A

HERBICIDE RUNOFF

Transport Modeling of an Agricultural Herbicide, A Laboratory Simulation,
W84-00969 5B

HERBICIDES

Site Studies of Determine the Extent and Potential Impact of Herbicide Contamination in Kansas Waters,
W84-00970 5B

HIGH PLAINS AQUIFER

Percentage Change in Saturated Thickness of the High Plains Aquifer, West-Central Kansas, 1950 to Average 1980-82,
W84-00821 7C

HIGH PLAINS AQUIFER SYSTEM

Geohydrology of the High Plains Aquifer System in Nebraska,
W84-01002 7C

HIGH PLAINS REGIONAL AQUIFER SYSTEM

Saturated Thickness of the High Plains Regional Aquifer in 1980, Northwestern Oklahoma,
W84-00804 7C

HISTORIC FLOODS

Historic and Prehistoric Patterns of Water Use in the Connecticut River Valley: Implications for Water Resources Planning,
W84-00968 6D

HOUSATONIC RIVER

Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport,
W84-00999 5B

HYDRAULIC CONDUCTIVITY

Results of Hydraulic Tests in U.S. Department of Energy's Wells Doe-4, 5, 6, 7, 8 and 9, Salt Valley, Grand County, Utah,
W84-01039 2F

HYDROELECTRIC PLANTS

Water, Watts, and Wilds: Hydropower and Competing Uses in New England.
W84-00914 6D

HYDROELECTRIC POWER

Water, Watts, and Wilds: Hydropower and Competing Uses in New England.
W84-00914 6D

HYDROGEN ION CONCENTRATION

Today's Status of pH Measurement and Control in Desalination Plants,
W84-00718 3A

Iron in Ground Waters of the Magothy and Raritan Formations in Camden and Burlington Counties, New Jersey,
W84-00790 5B

HYDROGEOLOGY

Ground Water and Geology of Marquette County, Michigan,
W84-00925 2F

Geohydrologic Reconnaissance of Lake Mead National Recreation Area--Las Vegas Wash to Opal Mountain, Nevada,
W84-00934 2F

Major Aquifers in Hanson and Davison Counties, South Dakota,
W84-00978 2F

Major Aquifers in Yankton County, South Dakota,
W84-00979 2F

Hydrogeology of the Providence Aquifer of Southwest Georgia,
W84-01031 2F

HYDROGRAPH

Selected Flow Characteristics of Florida Streams and Canals,
W84-01012 7C

HYDROGRAPHS

Floods of October 1977 in Southern Arizona and March 1978 in Central Arizona,
W84-00953 2E

HYDROLOGIC BUDGET

A Hydrologic Analysis of the New Jersey Pine Barrens Region,
W84-00781 2A

General Hydrology and External Sources of Nutrients Affecting Pine Lake, King County, Washington,
W84-01015 2H

HYDROLOGIC DATA

Percentage Change in Saturated Thickness of the High Plains Aquifer, West-Central Kansas, 1950 to Average 1980-82,
W84-00821 7C

Drainage Divides, Massachusetts--Nashua and Concord River Basins,
W84-00822 7C

Effects of Urbanization on the Magnitude and Frequency of Floods on Small Streams in Tennessee-Basic Data Report No. 2,
W84-00826 4C

Water-Resources Investigations of the U.S. Geological Survey in South Dakota,
W84-00827 7A

Long Range Plans for Hydrologic Investigations,
W84-00852 6B

Hydrologic Data for Urban Storm Runoff in the Denver Metropolitan Area, Colorado,
W84-00859 7C

Water Quality of the Potomac River at Chain Bridge at Washington, D.C., Hydrologic Data Report, 1978 Water Year,
W84-00861 7C

Selective Annotated Bibliography of Ground-Water Resources, Records of Wells and Springs, and Availability of Streamflow Data on Indian Reservations in Montana,
W84-00863 7C

Geohydrologic Data from Sandstone Aquifers in Southwestern Kansas,
W84-00864 7C

Annual Water-Resources Review, white Sands Missile Range, New Mexico, 1981,
W84-00872 2F

Revised Description of Index of Florida Water Data Collection Active Stations and a User's Guide for Station or Site Information Retrieval Computer Program Findex H578,
W84-00885 10D

Potential Effects of Surface Coal Mining on the Hydrology of the Cook Creek Area, Ashland Coal Field, Southeastern Montana,
W84-00899 4C

Water Quality of the Tidal River and Estuary; Hydrologic Data Report, 1981 Water Year with a Section on Chlorophyll-A: Collection and Analysis,
W84-00906 7C

Hydrologic Data From Monitoring of Saline-Water Intrusion in the Cape Coral Area, Lee County, Florida,
W84-00935 7C

Data from the Surface-Water Hydrologic Investigations of the Hay Creek Study Area, Montana, and the West Branch Antelope Creek Study Area, North Dakota, October 1976 through April 1982,
W84-00976 7C

January 1982 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W84-00981 7C

Water Resources Data, North Carolina, Water Year 1982,
W84-01028 7C

Water Resources Data for Puerto Rico, 1981-82,
W84-01044 7C

HYDROLOGIC DATA COLLECTION

Funding History of the U.S. Geological Survey Federal Data Collection and Analysis Program,
W84-00836 9D

HYDROLOGIC DATA COLLECTIONS

Statistical Summaries of New Jersey Streamflow Records,
W84-00800 7C

Historic and Prehistoric Patterns of Water Use in the Connecticut River Valley: Implications for Water Resources Planning,
W84-00968 6D

HYDROLOGIC-DATA PROGRAM

Water-Resources Investigations of the U. S. Geological Survey in Missouri, Fiscal Year 1983,
W84-00862 7C

HYDROLOGIC MODEL

Preliminary Evaluation of the Ground-Water-Flow System in the Twin Cities Metropolitan Area, Minnesota,
W84-00995 2F

HYDROLOGIC MONITORING

Hydrology of Coal-Resource Areas in the Southern Wasatch Plateau, Central Utah,
W84-00893 2A

HYDROLOGIC SYSTEM

Evaluation of the Hydrologic System in the New Leipzig Coal Area, Grant and Hettinger Counties, North Dakota,
W84-01022 2F

HYDROLOGIC SYSTEMS

Preliminary Evaluation of the Ground-Water-Flow System in the Twin Cities Metropolitan Area, Minnesota,
W84-00995 2F

HYDROLOGIC WETLANDS CLASSIFICATION

Hydrology of Wisconsin, Wetlands,
W84-00998 2H

HYDROLOGICAL DATA

Evaluation of Selected One-Dimensional Stream Water Quality Models with Field Data,
W84-01027 5B

HYDROLOGY
Origin of Subsurface Water in Khartoum Province, Sudan,
W84-00748 3A

HYDROPOWER SIMULATION
Integrating Intermittent and Renewable Power Resources into the Hydropower system of the Pacific Northwest,
W84-00958 6A

HYPERFILTRATION
Closed Cycle Textile Dyeing:Full Scale Renovation of Hot Wash Water by Hyperfiltration,
W84-00749 3A

IDAHO
Hydrographs of Water Levels in Observation Wells in Idaho, 1971-82,
W84-00831 7C

Compilation of Ground-Water Quality Data for Selected Wells in Elmore, Owyhee, Ada, and Canyon Counties, Idaho, 1945 through 1982,
W84-00834 7C

Activities in Idaho, Status of Projects, Fiscal Years 1982-83.
W84-00835 9D

An Evaluation of Idaho Stream-Gaging Networks,
W84-00866 7A

Ground-Water Conditions in the Eastern Part of Michaud Flats, Fort Hall Indian Reservation, Idaho,
W84-00879 2F

Reconnaissance of Ground-Water Quality, Eastern Snake River Basin, Idaho,
W84-00974 2F

Evaluation of Water-Quality Characteristics of Part of the Spokane Aquifer, Washington and Idaho, Using a Solute-Transport Digital Model,
W84-01001 2F

ILLINOIS
Proceedings: Illinois Water-Data Users Meeting, Peoria, Illinois, February 23-24, 1982.
W84-00818 7A

Hydrologic Effects of Storing Liquified Sewage Sludge on Strip-Mined Land in Fulton County, Illinois,
W84-00977 5E

IMPAIRED WATER QUALITY
Subbasin 15, Lake Erie,
W84-00840 6B

Premining Hydrology of the Lignite Area in Southeastern De Soto Parish, Louisiana,
W84-01006 4C

INDEXES
Definitions of Components of the Master Water Data Index Maintained by the National Water Data Exchange,
W84-00778 10A

INDEXING
Directory of Assistance Centers of the National Water Data Exchange (NAWDEX),
W84-00814 10D

INDIAN RESERVATIONS
Selective Annotated Bibliography of Ground-Water Resources, Records of Wells and Springs, and Availability of Streamflow Data on Indian Reservations in Montana,
W84-00863 7C

INDIANA
Reconnaissance for Determining Effects of Land Use and Surficial Geology on Concentrations of Selected Elements on Streambed Materials from the Coal Mining, Region, Southwestern Indiana, October 1979 to March 1980,
W84-00771 5B

Reconnaissance of Stream Biota and Physical and Chemical Quality from Selected Land Use on Stream Biology in the Coal-Mining Region, Southwestern Indiana, 1979-80,
W84-00876 5B

Water Quality Monitoring - Rivers and Streams, 1982.
W84-00910 7C

Ground-Water Resources of the White River Basin, Hamilton and Tipton Counties, Indiana,
W84-00930 2F

Ground-Water Resources of the White River Basin, Delaware County, Indiana, 1977,
W84-00931 2F

INDUSTRIAL PLANTS
Industrial Wastewater,
W84-00917 5G

INDUSTRIAL WASTE
State Water Plan: Subbasin 10, Lower West Branch Susquehanna River.
W84-00843 6B

INDUSTRIAL WASTES
Status of Ground Water Quality in Logan Township, Gloucester County,
W84-00782 5B

The State Water Plan, Subbasin 20, Ohio River.
W84-00787 5B

Subbasin 11, Upper Juniata River,
W84-00839 6B

Subbasin 15, Lake Erie,
W84-00840 6B

Subbasin 13, Potcmac River.
W84-00841 6D

Hydrocarbon Fuels in Ground Water--Increased Awareness and Concern in New Mexico,
W84-00854 5B

Industrial Wastewater,
W84-00917 5G

Municipal Wastewater Treatment: 1970 and Today,
W84-00918 5G

INDUSTRIAL WASTEWATER
State Water Plan: Subbasin 4, Upper Susquehanna River.
W84-00849 6B

Industrial Wastewater,
W84-00917 5G

INFILTRATION
Mathematical Models of Soil Moisture Profiles Using Two-Phase Flow Theory,
W84-00966 2G

INFORMATION AND EXCHANGE
Indentification Codes for Organizations Listed in Computerized Data Systems of the U.S. Geological Survey,
W84-00817 10D

INFORMATION EXCHANGE
Directory of Assistance Centers of the National Water Data Exchange (NAWDEX),
W84-00814 10D

Directory of Member Organizations of the Naitonal Water Data Exchange (NAWDEX),
W84-00816 10D

INFORMATION RETRIEVAL
Definitions of Components of the Master Water Data Index Maintained by the National Water Data Exchange,
W84-00778 10A

Definitions of Components of the Water Data Sources Directory Maintained by the National Water Data Exchange,
W84-00815 10D

INFORMATION SYSTEMS
Definitions of Components of the Master Water Data Index Maintained by the National Water Data Exchange,
W84-00778 10A

Directory of Member Organizations of the Naitonal Water Data Exchange (NAWDEX),
W84-00816 10D

INJECTION WELLS
Geohydrologic Reconnaissance of Drainage Wells in Florida--An Interim Report,
W84-00865 4B

Data on Subsurface Storage of Liquid Waste Near Pensacola, Florida, 1963-1980,
W84-00951 7C

INLAND WATERWAYS
Hydrologic Monitoring in the Area of the Proposed Yazoo River Navigation Project, West Central Mississippi, 1978-80,
W84-00942 7C

INSTITUTIONAL CONSTRAINTS
Problems and Issues Related to Managing Water Supply and Water Quality Between North Carolina and Virginia,
W84-00961 6E

INSTRUMENTATION
Installation and Service Manual for U.S. Geological Survey Manometers,
W84-00811 7B

Quality Assurance Practices for the Chemical and Physical Analyses of Water and Fluvial Sediments,
W84-00812 5A

INTER-AQUIFER LEAKAGE
Geohydrology of the Fresh-Water Aquifer System in the Vicinity of Ocean City, Maryland,
W84-01011 2F

INTERAGENCY COOPERATION
Harbor Management Strategies for New England,
W84-00907 6B

Report on Review of Water Supply Planning, Recommendations and Strategy for Western Connecticut.
W84-00911 6B

INTERCEPTION
A Hydrologic Analysis of the New Jersey Pine Barrens Region,
W84-00781 2A

INTERSTATE COMMISSIONS
Problems and Issues Related to Managing Water Supply and Water Quality Between North Carolina and Virginia,
W84-00961 6E

INTERSTATE COMPACTS
Interstate Water Law Issues: Unilateral State Legislation, Original Suits in the Supreme Court, Interstate Compacts,
W84-00960 6E

INTERSTATE RIVERS
Subbasin 13, Potomac River.
W84-00841 6D

ION EXCHANGE
Removing Uranium From Drinking Water Supplies: Demonstration of Selected Ion Exchange and Chemical Clarification,
W84-00857 5F

IONS
Ground Water Quality in the South of Albuquerque,
W84-00856 5B

IPSWICH RIVER
Drainage Divides, Massachusetts--Ipswich and Lower Merrimack River Basins and Northeast Coastal Basins,
W84-00833 7C

IRON
Iron in Ground Waters of the Magothy and Raritan Formations in Camden and Burlington Counties, New Jersey,
W84-00790 5B

Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

IRRIGATION PRACTICES
An Engineering Economic Analysis of Artificial Recharge in a Conjunctive Irrigation Plan in the Columbia Basin Project, Washington,
W84-00989 4B

IRRIGATION REQUIREMENTS
Determination of Irrigation Pumpage in Parts of Kearny and Finney Counties, Southwestern Kansas,
W84-00772 6D

Subbasin 13, Potomac River.
W84-00841 6D

Subbasin 12, Lower Juniata River.
W84-00842 6D

IRRIGATION WATER
The Benchmark Farm Program-- A Method for Estimating Irrigation Water Use in Southwest Florida,
W84-00808 7C

JUDICIAL DECISIONS
Interstate Water Law Issues: Unilateral State Legislation, Original Suits in the Supreme Court, Interstate Compacts,
W84-00960 6E

KANSAS
Determination of Irrigation Pumpage in Parts of Kearny and Finney Counties, Southwestern Kansas,
W84-00772 6D

Percentage Change in Saturated Thickness of the High Plains Aquifer, West-Central Kansas, 1950 to Average 1980-82,
W84-00821 7C

Geohydrologic Data from Sandstone Aquifers in Southwestern Kansas,
W84-00864 7C

Statistical Summaries of Selected Chemical Constituents in Kansas Ground-Water Supplies,
W84-00869 2F

Site Studies of Determine the Extent and Potential Impact of Herbicide Contamination in Kansas Waters,
W84-00970 5B

January 1982 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W84-00981 7C

Analysis and Computer Simulation of Stream-Aquifer Hydrology, Arkansas River Valley, Southwestern Kansas,
W84-01016 2A

Water-Quality and Fluvial-Sediment Characteristics of Selected Streams in Northeast Kansas,
W84-01045 2J

KENTUCKY
Chloroform Contamination in Part of the Alluvial Aquifer, Southwest Louisville, Kentucky,
W84-01030 5B

KRIGING
Percentage Change in Saturated Thickness of the High Plains Aquifer, West-Central Kansas, 1950 to Average 1980-82,
W84-00821 7C

Semi-Variogram Estimation and Universal Kriging Program (Computer Program Documentation, User's Manual),
W84-00829 7C

LABORATORY SIMULATION
Transport Modeling of an Agricultural Herbicide, A Laboratory Simulation,
W84-00969 5B

LAKE EUTROPHICATION
Lake Phosphorus Loading From Septic Systems by Seasonally Perched Ground Water, Puget Sound Region, Washington,
W84-00883 5B

LAKE LEVELS
Hydrology of the Hamilton Lakes and Vicinity, Polk County, Central Florida,
W84-00905 7C

LAKE MORPHOMETRY
Limnological Characteristics of Wisconsin Lakes,
W84-00794 2H

LAKE REHABILITATION
Municipal Wastewater Treatment: 1970 and Today,
W84-00918 5G

LAKE SEDIMENTS
Computer Simulation of Phosphorus Cycling in the Sediment-Water System of Eutrophic Lakes,
W84-00964 2H

LAKE SOILS
Subbasin 15, Lake Erie,
W84-00840 6B

LAKE TEXOMA
Localized Destratification at Lake Texoma,
W84-00956 5G

LAKES
Limnological Characteristics of Wisconsin Lakes,
W84-00794 2H

Hydrology of the Hamilton Lakes and Vicinity, Polk County, Central Florida,
W84-00905 7C

General Hydrology and External Sources of Nutrients Affecting Pine Lake, King County, Washington,
W84-01015 2H

LAND DISPOSAL
Health and Safety Aspects of Irrigation of Raw-Eaten Food Crops with Reused Water,
W84-00767 5D

LAND DRAINAGE
Changes in Flood Response of the Red River of the North Basin, North Dakota-Minnesota,
W84-01020 4C

LAND USE
Reconnaissance for Determining Effects of Land Use and Surficial Geology on Concentrations of Selected Elements on Streambed Materials from the Coal Mining, Region, Southwestern Indiana, October 1979 to March 1980,
W84-00771 5B

Changes in Flood Response of the Red River of the North Basin, North Dakota-Minnesota,
W84-01020 4C

LANDFILL
Water-Quality Reconnaisance of the North Data County Solid-Waste Disposal Facility, Florida,
W84-00874 5B

LANDFILL LEACHATE
Hydrogeology of a Landfill Operation, Pinellas County, Florida,
W84-00996 5B

LANDFILLS
Hydrogeology of a Landfill Operation, Pinellas County, Florida,
W84-00996 5B

LEACHATE
Water-Quality Reconnaisance of the North Data County Solid-Waste Disposal Facility, Florida,
W84-00874 5B

LEACHATE MOVEMENT
Hydrogeology of a Landfill Operation, Pinellas County, Florida,
W84-00996 5B

LEACHATES
Subbasins 14 and 16, Genesee River and Upper Allegheny River,
W84-00838 6B

Subbasin 11, Upper Juniata River,
W84-00839 6B

LEGAL ASPECTS
Municipal Wastewater Treatment: 1970 and Today,
W84-00918 5G

Interstate Water Law Issues: Unilateral State Legislation, Original Suits in the Supreme Court, Interstate Compacts,
W84-00960 6E

Problems and Issues Related to Managing Water Supply and Water Quality Between North Carolina and Virginia,
W84-00961 6E

LEGISLATION
Municipal Wastewater Treatment: 1970 and Today,
W84-00918 5G

LIBYA
Instrumentation Problems in Libyn Desalination Plants,
W84-00719 3A

LIMESTONE
Predevelopment Flow in the Tertiary Limestone Aquifer, Southeastern United States: A Regional Analysis From Digital Modeling,
W84-00884 2F

LIMNOLOGY
Limnological Characteristics of Wisconsin Lakes,
W84-00794 2H

Water-Quality Assessment of Francis E. Walter Reservoir, Luzerne and Carbon Counties, Pennsylvania,
W84-01029 2H

LITHOLOGIC LOGS
Records of Selected Wells and Lithologic Logs of Test Holes, Hendry County and Adjacent Areas, Florida,
W84-00945 7C

LONG-RANGE PLANNING
Harbor Management Strategies for New England,
W84-00907 6B

Prospects and Strategies for New England Ports.
W84-00908 6B

LONG-TERM PLANNING
Morris County Master Plan: Water Supply Element.
W84-00788 6D

State Water Plan: Subbasin 6, Lower Central Susquehanna River.
W84-00847 6D

State Water Plan: Subbasin 1, Upper Delaware River.
W84-00850 6B

Long Range Plans for Hydrologic Investigations,
W84-00852 6B

LOUISIANA
A Two-Dimensional Finite-Element Model Study of Backwater and Flow Distribution at the I-10 Crossing of the Pearl River Near Slidell, Louisiana,
W84-00896 2A

Water Quality of the Barataria Marsh Unit, Jean Lafitte National Historic Park, Louisiana (April 1981-March 1982),
W84-00900 7C

Pumpage of Water in Louisiana, 1980,
W84-00997 6D

Premining Hydrology of the Lignite Area in Southeastern De Soto Parish, Louisiana,
W84-01006 4C

Hydrology, Water Quality, and Biology of Baptiste Collette Bayou in Relation to the Mississippi River at Venice, Louisiana,
W84-01025 5B

Water Quality of the Upper Vermilion River, Louisiana, April-August 1980,
W84-01046 5B

LOW FLOW
Water Information for Northwestern Missouri--A Planning Document,
W84-00810 3B

Monthly Low-Flow Characteristics of Georgia Streams,
W84-00923 7C

Graphical Method for Estimating Occurrence and Duration of a Critical Low Flow in the Sacramento River at Freeport, California,
W84-00973 5G

Identification and Classification of Perennial Streams of Arkansas,
W84-01041 7C

LOW-FLOW FREQUENCY
Selected Flow Characteristics of Florida Streams and Canals,
W84-01012 7C

LOW FLOWS
Streamflow and Sediment Transport in the Quillayute River Basin, Washington,
W84-00920 2J

LOWER MISSISSIPPI RIVER
Hydrology, Water Quality, and Biology of Baptiste Collette Bayou in Relation to the Mississippi River at Venice, Louisiana,
W84-01025 5B

MACROPHYTES
Site Studies of Determine the Extent and Potential Impact of Herbicide Contamination in Kansas Waters,
W84-00970 5B

MAINE
Computer Simulation of Phosphorus Cycling in the Sediment-Water System of Eutrophic Lakes,
W84-00964 2H

MANAGEMENT PLANNING
Handling of Fuzzy Decisions in the Engineering Management of Large Desalination Plants,
W84-00766 3A

Harbor Management Strategies for New England,
W84-00907 6B

Prospects and Strategies for New England Ports.
W84-00908 6B

MANOMETERS
Installation and Service Manual for U.S. Geological Survey Manometers,
W84-00811 7B

MANUFACTURING WASTES
Industrial Wastewater,
W84-00917 5G

MAPS
Semiannual Water-Level and Potentiometric Contours of Two Water-Yielding Zones in the Surficial Aquifer, 1975-79, Naples, Florida,
W84-00803 7C

Saturated Thickness of the High Plains Regional Aquifer in 1980, Northwestern Oklahoma,
W84-00804 7C

Chemical Quality of Water in the Upper Part of the Floridian Aquifer, Duval County, Florida,
W84-00806 7C

Map Showing Groundwater Conditions in the Tonto Basin Area, Gila County, Arizona--1979,
W84-00807 7C

Potentiometric Surface of the Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida, May 1982,
W84-00819 7C

Map of the Antelope Valley-East Kern Water Agency Area, California, Showing Ground-Water Subunits and Areas, and Well Hydrographs, 1962 to 1982,
W84-00820 7C

Percentage Change in Saturated Thickness of the High Plains Aquifer, West-Central Kansas, 1950 to Average 1980-82,
W84-00821 7C

Drainage Divides, Massachusetts--Nashua and Concord River Basins,
W84-00822 7C

Annual Summary of Ground-Water Conditions in Arizona, Spring 1981 to Spring 1982,
W84-00824 7C

Ground-Water Levels in Selected Well Fields and in West-Central Florida, May 1982,
W84-00867 7C

Drainage Divides, Massachusetts--Taunton River Basin and Southeast Coastal Basins,
W84-00868 7C

Potentiometric-Surface Map of Water in the Judith River Formation in the Northern Great Plains Area of Montana,
W84-00877 7C

Potentiometric-Surface Map of Water in the Lakota Formation and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00881 7C

Estimated Water Use in Missouri, 1980,
W84-00894 7C

Consumptive Use of Freshwater in Florida, 1980,
W84-00898 7C

Drainage Divides, Massachusetts--Connecticut River Lowlands and Chicopee River Basin,
W84-00902 7C

Potentiometric-Surface Map of Water in the Fox Hills Lower Hell Creek Aquifer in the Northern Great Plains are of Montana,
W84-00903 7C

Hydrology of the Hamilton Lakes and Vicinity, Polk County, Central Florida,
W84-00905 7C

Water-Level Maps of the Alluvial Aquifer, Northwestern Mississippi September 1981,
W84-00921 7C

Approximate Altitude of Water Levels in Wells in the Chicot and Evangeline Aquifers in the Houston Area, Texas, Spring 1982,
W84-00922 7C

Annual Summary of Ground-Water Conditions in Arizona, Spring 1980 to Spring 1981.
W84-00941 7C

Index of Hydrologic Data for Selected Sites in Broward County, Florida, 1939-80,
W84-00943 7C

Potentiometric-Surface Map of Water in the Eagle Sandstone and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00949 7C

Geohydrology of the Floridan Aquifer in the Withlacoochee River Basin of the Southwest Florida Water Management District,
W84-00984 7C

Geohydrology of the High Plains Aquifer System in Nebraska,
W84-01002 7C

Principal Aquifers in Florida,
W84-01004 7C

Potentiometric Surface of the Floridan Aquifer in Florida, May 1980,
W84-01005 7C

MARINE OSMOTIC SOLAR STILL
Development of a Marine Osmotic Solar Still for a Sea Water Desalination,
W84-00736 3A

MARINE RESOURCES
Literature Assessment of the Charlotte Harbor Estuarine System and Surrounding Area, Southwest Florida,
W84-00992 10C

MASS SPECTROMETRY
Specific Identification of Organic Pollutants in Haw River Water Using Gas Chromatography/Mass Spectrometry,
W84-00959 5A

MASSACHUSETTS
Drainage Divides, Massachusetts--Nashua and Concord River Basins,
W84-00822 7C

MASSACHUSETTS

Drainage Divides, Massachusetts--Ipswich and Lower Merrimack River Basins and Northeast Coastal Basins,
W84-00833 7C

Drainage Divides, Massachusetts--Taunton River Basin and Southeast Coastal Basins,
W84-00868 7C

Drainage Divides, Massachusetts--Connecticut River Lowlands and Chicopee River Basin,
W84-00902 7C

Potential Hydrologic Impacts of Ground-Water Withdrawals from the Cape Cod National Seashore, Truro, Massachusetts,
W84-00944 2F

Hydrogeochemical Cycling in a Watershed-Groundwater System: Fort River and Cadwell Creek, Massachusetts,
W84-00967 5B

Estimating Peak Discharges of Small Rural Streams in Massachusetts,
W84-00990 2E

Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport,
W84-00999 5B

MATHEMATICAL STUDIES

Mathematical Models of Soil Moisture Profiles Using Two-Phase Flow Theory,
W84-00966 2G

MAXIMUM CONCENTRATION

Time of Travel of Selected Arkansas Streams,
W84-00895 2E

MEAT PROCESSING INDUSTRY

Ultrafiltration of Effluents from Slaughterhouses and Brine in the Meat Industry,
W84-00705 3A

MEMBRANE PROCESSES

Closing Remarks,
W84-00715 3A

MEMBRANE TECHNOLOGY

Membrane Technology in the Pulp and Paper Industry,
W84-00704 3A

MEMBRANES

Utilization of the New Mineral UF Membranes for Making Semi-hard Cheeses,
W84-00701 3A

Membrane Processes for Water, Pulp and Paper, Food. State of the Art,
W84-00702 3A

Conceptual Design Aspects of Reverse Osmosis,
W84-00703 3A

Application of Selective Membranes in Grape Juice Stabilization,
W84-00706 3A

Membrane Technology and Biotechnology,
W84-00707 3A

Biocatalysis by Membrane-Attached Enzymes and Whole Microbial Cells,
W84-00708 3A

Membrane Technology Applied to Bioconversion of Macromolecular Substrates and Upgrading of Products. A Model Study on Ethanol Production from Cellulose,
W84-00709 3A

Membrane Technology and Costs; State of the Art,
W84-00710 3A

Membrane Life, Capacity and Costs,
W84-00711 3A

Preconcentration by Reverse Osmosis Before Evaporation - Possibilities in Sweden,
W84-00714 3A

Operating Experience on Ro Sea Water Desalination Plant at Chigasaki Laboratory,
W84-00759 3A

MERRIMACK RIVER

Drainage Divides, Massachusetts--Ipswich and Lower Merrimack River Basins and Northeast Coastal Basins,
W84-00833 7C

MICHIGAN

Ground-Water Data for Michigan, 1981,
W84-00875 7C

Ground Water for Public Supply at Windigo, Isle Royale National Park, Michigan,
W84-00880 2F

Ground Water and Geology of Marquette County, Michigan,
W84-00925 2F

Water Quality of Coal Deposits and Abandoned Mines, Saginaw County, Michigan,
W84-00926 7C

MICROBIOLOGICAL STUDIES

Biocatalysis by Membrane-Attached Enzymes and Whole Microbial Cells,
W84-00708 3A

MINE DEWATERING

Hydrology of Coal-Resource Areas in the Southern Wasatch Plateau, Central Utah,
W84-00893 2A

MINE DRAINAGE

Procedures for Assessment of Cumulative Impacts of Coal Mining on the Hydrologic Balance,
W84-00780 4C

MINERALOGY

Mineralogy of Fine-Grained Alluvium from Borehole U11g, Expl. 1, Northern Frenchman Flat Area, Nevada Test Site,
W84-00946 2J

MINERALS

Ground Water Quality in the South of Albuquerque,
W84-00856 5B

MINNESOTA

Streamflow and Suspended-Sediment Transport in Garvin Brook, Winona County, Southeastern Minnesota Hydrologic Data for 1982,
W84-00832 2J

Baseline Water-Quality Data for Sand-Plain Aquifers in Hubbard, Morrison, Otter Tail, and Wadena Counties, Minnesota,
W84-00882 7C

Hydrologic Data for the Pelican River Sands Aquifer, Western Minnesota,
W84-00947 7C

Quality of Runoff From Small Watersheds in the Twin Cities Metropolitan Area, Minnesota--Hydrologic Data for 1980,
W84-00982 7C

Appraisal of Water From the Pelican River Sand-Plain Aquifer, West-Central Minnesota,
W84-00988 2F

Preliminary Evaluation of the Ground-Water-Flow System in the Twin Cities Metropolitan Area, Minnesota,
W84-00995 2F

Small-Stream Flood Investigations in Minnesota, October 1958 to September 1980,
W84-01033 7C

MINNESOTA RIVER

Annotated Report and Data Inventory for the Mississippi River Quality-Assessment, Minneapolis-St. Paul Metropolitan Area,
W84-00860 10C

MISSISSIPPI

Water-Level Maps of the Alluvial Aquifer, Northwestern Mississippi September 1981,
W84-00921 7C

Hydrologic Monitoring in the Area of the Proposed Yazoo River Navigation Project, West Central Mississippi, 1978-80,
W84-00942 7C

Quality of Water in Luxapallila Creek at Columbus, Mississippi,
W84-01034 5B

Quality of Water and Time of Travel in Bakers Creek Near Clinton, Mississippi,
W84-01035 5B

MISSISSIPPI RIVER

Annotated Report and Data Inventory for the Mississippi River Quality-Assessment, Minneapolis-St. Paul Metropolitan Area,
W84-00860 10C

Preliminary Evaluation of the Ground-Water-Flow System in the Twin Cities Metropolitan Area, Minnesota,
W84-00995 2F

MISSISSIPPI RIVER BASIN

Floods of December 1982 and January 1983 in Central and Southern Mississippi River Basin,
W84-00886 7C

MISSOURI

Water Information for Northwestern Missouri--A Planning Document,
W84-00810 3B

Water-Resources Investigations of the U. S. Geological Survey in Missouri, Fiscal Year 1983,
W84-00862 7C

Estimated Water Use in Missouri, 1980,
W84-00894 7C

MIXING

Localized Destratification at Lake Texoma,
W84-00956 5G

MODEL ASSESSMENT

A Two-Dimensional Finite-Element Model Study of Backwater and Flow Distribution at the I-10 Crossing of the Pearl River Near Slidell, Louisiana,
W84-00896 2A

MODEL COMPARISON

Evaluation of Selected One-Dimensional Stream Water Quality Models with Field Data,
W84-01027 5B

MODEL SIMULATIONS

Geohydrology of the Fresh-Water Aquifer System in the Vicinity of Ocean City, Maryland,
W84-01011 2F

MODEL STUDIES

Predevelopment Flow in the Tertiary Limestone Aquifer, Southeastern United States: A Regional Analysis From Digital Modeling,
W84-00884 2F

A Two-Dimensional Finite-Element Model Study of Backwater and Flow Distribution at the I-10 Crossing of the Pearl River Near Slidell, Louisiana,
W84-00896 2A

The Economic Value of Ground Water Recharge for Irrigation Use,
W84-00957 4B

Mathematical Models of Soil Moisture Profiles Using Two-Phase Flow Theory,
W84-00966 2G

Estimating Peak Discharges of Small Rural Streams in Massachusetts,
W84-00990 2E

Literature Assessment of the Charlotte Harbor Estuarine System and Surrounding Area, Southwest Florida,
W84-00992 10C

Hydrogeology and Simulation Model of Water Flow in the Kootenai Aquifer of the Judith Basin, Central Montana,
W84-01009 2F

Hydrologic Analysis of the Upper San Pedro Basin from the Mexico-United States International Boundary to Fairbank, Arizona,
W84-01023 2A

MONTANA
Selective Annotated Bibliography of Ground-Water Resources, Records of Wells and Springs, and Availability of Streamflow Data on Indian Reservations in Montana,
W84-00863 7C

Potentiometric-Surface Map of Water in the Judith River Formation in the Northern Great Plains Area of Montana,
W84-00877 7C

Potentiometric-Surface Map of Water in the Lakota Formation and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00881 7C

Potential Effects of Surface Coal Mining on the Hydrology of the Cook Creek Area, Ashland Coal Field, Southeastern Montana,
W84-00899 4C

Potentiometric-Surface Map of Water in the Fox Hills Lower Hell Creek Aquifer in the Northern Great Plains are of Montana,
W84-00903 7C

Potentiometric-Surface Map of Water in the Eagle Sandstone and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00949 7C

Data from the Surface-Water Hydrologic Investigations of the Hay Creek Study Area, Montana, and the West Branch Antelope Creek Study Area, North Dakota, October 1976 through April 1982,
W84-00976 7C

Hydrogeology and Simulation Model of Water Flow in the Kootenai Aquifer of the Judith Basin, Central Montana,
W84-01009 2F

Hydrology of Area 49, Northern Great Plains and Rocky Mountain Coal Provinces, Montana and Wyoming,
W84-01043 2A

MONTHLY FREQUENCY
Monthly Low-Flow Characteristics of Georgia Streams,
W84-00923 7C

MULTIEFFECT DISTILLATION
Usability of Low Temperature Waste Heat for Sea Water Desalination,
W84-00732 3A

MULTIEFFECT FLASH
Test Results from a Solar Boiler for Saline Water Distillation,
W84-00724 3A

MULTISTAGE FLASH
Today's Status of pH Measurement and Control in Desalination Plants,
W84-00718 3A

Control and Instrumentation Experience at Lok on Pai Msf Seawater Desalination Plant,
W84-00720 3A

Design and Operation Experience with Solar Powered Multistage Desalination Plants,
W84-00728 3A

MULTISTAGE FLASH DISTILLATION
Operational Experience of 2 x 11,500 m super 3 d Msf Seawater Desalination Plant,
W84-00741 3A

Experience in Commissioning Large Desalination Plants in the Middle East,
W84-00742 3A

Reducing and Monitoring Corrosion in MSF Evaporators in the Change-Over From Acid Treatment to Treatment with Additives,
W84-00753 3A

Studies, Testing and Development of a Line of Brine Recirculating Pumps for Sea Water Desalination Installations,
W84-00754 3A

Combined MSF/VTE-Modules for Hybrid Thermal Seawater Desalination Plants,
W84-00756 3A

MULTISTAGE FLASH/VERTICAL TUBE EVAPORATOR
An Integrated Self Sufficient Multipurpose Plant for Seawater Desalination,
W84-00763 3A

MUNICIPAL WASTES
Subbasin 11, Upper Juniata River,
W84-00839 6B

Subbasin 15, Lake Erie,
W84-00840 6B

State Water Plan: Subbasin 7, Lower Susquehanna River.
W84-00846 6B

Municipal Wastewater Treatment: 1970 and Today,
W84-00918 5G

MUNICIPAL WASTEWATER
Municipal Wastewater Treatment: 1970 and Today,
W84-00918 5G

MUNICIPAL WATER
Water Use in Wisconsin, 1979,
W84-00928 7C

MUSSELS
A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River,
W84-00909 5C

NATIONAL STREAM QUALITY ACCOUNTING NETWORK
Funding History of the U.S. Geological Survey Federal Data Collection and Analysis Program,
W84-00836 9D

NATIONAL WATER DATA EXCHANGE
Definitions of Components of the Master Water Data Index Maintained by the National Water Data Exchange,
W84-00778 10A

NATIONAL WATER DATA EXCHANGE (NAWDEX)
Directory of Assistance Centers of the National Water Data Exchange (NAWDEX),
W84-00814 10D

Definitions of Components of the Water Data Sources Directory Maintained by the National Water Data Exchange,
W84-00815 10D

NATURAL RECHARGE
A Natural Resource and Land Use Analysis of the Lacona Williamstown Portion of the Tug Hill Aquifer.
W84-00913 2F

NAVIGABLE RIVERS
A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River,
W84-00909 5C

NAWDEX MEMBERSHIP
Directory of Member Organizations of the Naitonal Water Data Exchange (NAWDEX),
W84-00816 10D

NEAP TIDES
Graphical Method for Estimating Occurrence and Duration of a Critical Low Flow in the Sacramento River at Freeport, California,
W84-00973 5G

NEBRASKA
The Economic Value of Ground Water Recharge for Irrigation Use,
W84-00957 4B

Geohydrology of the High Plains Aquifer System in Nebraska,
W84-01002 7C

NETWORK ANALYSIS
Evaluation of the Stream-flow Data in Pennsylvania,
W84-00809 7A

NETWORK DESIGN
An Evaluation of Idaho Stream-Gaging Networks,
W84-00866 7A

NETWORKS
Semi-Variogram Estimation and Universal Kriging Program (Computer Program Documentation, User's Manual),
W84-00829 7C

NEVADA
Geohydrologic Reconnaissance of Lake Mead National Recreation Area--Las Vegas Wash to Opal Mountain, Nevada,
W84-00934 2F

Mineralogy of Fine-Grained Alluvium from Borehole U11g, Expl. 1, Northern Frenchman Flat Area, Nevada Test Site,
W84-00946 2J

Gravity Survey of Dixie Valley, West-Central Nevada,
W84-01000 2F

Geothermal Resources of the Western Arm of the Black Rock Desert, Northwestern Nevada--Part I, Geology and Geophysics,
W84-01007 2F

Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan,
W84-01008 2F

NEW ENGLAND
Harbor Management Strategies for New England,
W84-00907 6B

NEW ENGLAND
Prospects and Strategies for New England Ports.
W84-00908 6B

Water, Watts, and Wilds: Hydropower and Competing Uses in New England.
W84-00914 6D

NEW JERSEY
Morris County Master Plan: Water Supply Element.
W84-00788 6D

Wanaque South Project Economic Feasibility Study, Executive Summary.
W84-00789 6B

Iron in Ground Waters of the Magothy and Raritan Formations in Camden and Burlington Counties, New Jersey,
W84-00790 5B

Geology and Ground Water Resources of Hunterdon County, New Jersey,
W84-00791 2F

Water Resources Resume: State Atlas Sheet No. 23, Parts of Bergen, Morris and Passaic Counties,
W84-00792 7C

Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

Geology and Ground-Water Resources of Salem County, New Jersey,
W84-00795 2F

Geology and Ground-Water Resources of the Rahway Area, New Jersey,
W84-00796 2F

Ground-Water Resources of Essex County, New Jersey,
W84-00797 2F

Water Resources and Geology of Gloucester County, New Jersey,
W84-00798 2F

Geology of the Ground Water Resources of Mercer County,
W84-00799 2F

Statistical Summaries of New Jersey Streamflow Records,
W84-00800 7C

Stream Surveillance and Analysis: Shabakunk Creek and Little Bear Brook Watersheds,
W84-00801 5B

Mercer County Stormwater Toxics Management Project: Delaware and Raritan Canal Conduit Special Study, Trenton, New Jersey.
W84-00802 5B

Drainage Areas in New Jersey: Delaware River Basin and Streams Tributary to Delaware Bay,
W84-00904 7C

Groundwater Quality in New Jersey--An Investigation of Toxic Contaminants,
W84-00912 5B

NEW MEXICO
Floods of November 1978 to March 1979 in Arizona and West-Central New Mexico,
W84-00837 7C

Long Range Plans for Hydrologic Investigations,
W84-00852 6B

The Puerco River: Muddy Issues Raised by a Mine Water Dominated Ephemeral Stream,
W84-00853 5B

Hydrocarbon Fuels in Ground Water--Increased Awareness and Concern in New Mexico,
W84-00854 5B

Point Source Waste Load Allocation for the Town of Red River,
W84-00855 5G

Ground Water Quality in the South of Albuquerque,
W84-00856 5B

Annual Water-Resources Review, white Sands Missile Range, New Mexico, 1981,
W84-00872 2F

Geologic and Well-Construction Data for the H-10 Borehole Complex Near the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico,
W84-00901 5E

NEW YORK
A Natural Resource and Land Use Analysis of the Lacona Williamstown Portion of the Tug Hill Aquifer.
W84-00913 2F

Atlas of Eleven Selected Aquifers in New York,
W84-00983 7C

Hydraulic Considerations in Sampling the Unsaturated Zone with Inclined Gravity Lysimeters,
W84-01018 2G

NITROGEN LOSSES
Nitrate Loss from Agricultural Drainage Waters: Implications for Nonpoint Source Control,
W84-00965 5B

NITROGEN MOVEMENT
Nitrate Loss from Agricultural Drainage Waters: Implications for Nonpoint Source Control,
W84-00965 5B

NONPOINT POLLUTION SOURCES
Nonpoint Sources,
W84-00916 6B

NORTH CAROLINA
Nitrate Loss from Agricultural Drainage Waters: Implications for Nonpoint Source Control,
W84-00965 5B

Water Resources Data, North Carolina, Water Year 1982,
W84-01028 7C

NORTH DAKOTA
Water-Resources Investigations in North Dakota--Fiscal Year 1983,
W84-00888 9C

Data from the Surface-Water Hydrologic Investigations of the Hay Creek Study Area, Montana, and the West Branch Antelope Creek Study Area, North Dakota, October 1976 through April 1982,
W84-00976 7C

Changes in Flood Response of the Red River of the North Basin, North Dakota-Minnesota,
W84-01020 4C

Evaluation of the Hydrologic System in the New Leipzig Coal Area, Grant and Hettinger Counties, North Dakota,
W84-01022 2F

Ground-Water Resources of Ransom and Sargent Counties, North Dakota,
W84-01050 2F

NOVA SCOTIA
Annapolis Points the Way for Fundy,
W84-00972 8A

NUTRIENTS
Reconnaissance of Stormwater-Runoff Water Quality of the Big Piney Creek Segment of the Cedar-Piney Watershed, Yell County, Arkansas,
W84-00933 5B

General Hydrology and External Sources of Nutrients Affecting Pine Lake, King County, Washington,
W84-01015 2H

Water-Quality Assessment of Francis E. Walter Reservoir, Luzerne and Carbon Counties, Pennsylvania,
W84-01029 2H

OBSERVATION WELLS
Hydrologic Data for the Pelican River Sands Aquifer, Western Minnesota,
W84-00947 7C

OBSERVATIONS WELLS
Ground-Water Levels in Wyoming, 1971 Through Part of 1980,
W84-00950 7C

OHIO
Model Modifications for Simulation of Flow Through Stratified Rocks in Eastern Ohio,
W84-00773 4C

Flood of June 13-15, 1981, in the Blanchard River Basin, Northwestern Ohio,
W84-00777 7C

OIL SHALE
A Plan for Hydrologic Investigations of In-Situ Oil Shale Retorting Near Rock Springs, Wyoming,
W84-00873 2F

Erosion and Sediment Characteristics of the Southeastern Uinta Basin, Utah and Colorado,
W84-01036 2J

OKLAHOMA
Saturated Thickness of the High Plains Regional Aquifer in 1980, Northwestern Oklahoma,
W84-00804 7C

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1982 Water Year,
W84-00891 7C

Localized Destratification at Lake Texoma,
W84-00956 5G

ON-SITE DATA COLLECTION
Statistical Summaries of New Jersey Streamflow Records,
W84-00800 7C

ON-SITE DATA COLLECTIONS
A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River,
W84-00909 5C

ON-SITE MONITORING WELLS
Data on Subsurface Storage of Liquid Waste Near Pensacola, Florida, 1963-1980,
W84-00951 7C

OREGON
Water-Quality Data for Smith and Bybee Lakes: Portland, Oregon, June to November, 1982,
W84-00890 7C

An Evaluation of Suspended Sediment and Turbidity in Cow Creek, Oregon,
W84-00939 2J

Flood Profiles in the Calapooya Creek Basin, Oregon,
W84-01021 7C

ORGANIC COMPOUNDS
Removal of Refractory Organics from Water by Aeration. II. Solvent Sublation of Methylene Blue and Methyl Orange,
W84-00954 5F

Specific Identification of Organic Pollutants in Haw River Water Using Gas Chromatography/Mass Spectrometry,
W84-00959 5A

ORGANIC SOLVENTS
Effect of Urbanization on the Water Resources of Warminster Township, Bucks County, Pennsylvania,
W84-00774 5B

Removal of Refractory Organics from Water by Aeration. II. Solvent Sublation of Methylene Blue and Methyl Orange,
W84-00954 5F

ORGANIC WASTES
Status of Ground Water Quality in Logan Township, Gloucester County,
W84-00782 5B

Ground Water Quality in the South of Albuquerque,
W84-00856 5B

ORGANIZATION IDENTIFICATION CODE
Indentification Codes for Organizations Listed in Computerized Data Systems of the U.S. Geological Survey,
W84-00817 10D

ORGANIZATIONS
Desalination in Mexico,
W84-00752 3A

Indentification Codes for Organizations Listed in Computerized Data Systems of the U.S. Geological Survey,
W84-00817 10D

OXYGEN DEMAND
Determination of Ultimate Carbonaceous BOD and the Specific Rate Constant (K sub 1),
W84-00805 5A

PACIFIC NORTHWEST U.S.
Integrating Intermittent and Renewable Power Resources into the Hydropower system of the Pacific Northwest,
W84-00958 6A

PARTICLE SIZE
Streamflow and Suspended-Sediment Transport in Garvin Brook, Winona County, Southeastern Minnesota Hydrologic Data for 1982,
W84-00832 2J

PATH OF POLLUTANTS
Chloroform Contamination in Part of the Alluvial Aquifer, Southwest Louisville, Kentucky,
W84-01030 5B

PEAK DISCHARGE
Techniques for Estimating Flood Hydrographs for Ungaged Urban Watersheds,
W84-00940 2E

Estimating Peak Discharges of Small Rural Streams in Massachusetts,
W84-00990 2E

Small-Stream Flood Investigations in Minnesota, October 1958 to September 1980,
W84-01033 7C

Annual Snowmelt and Rainfall Peak-Flow Data on Selected Foothills Region Streams, South Platte River Arkansas River, and Colorado River Basins, Colorado,
W84-01038 7C

PEAK DISCHARGES
Floods of November 1978 to March 1979 in Arizona and West-Central New Mexico,
W84-00837 7C

Floods of October 1977 in Southern Arizona and March 1978 in Central Arizona,
W84-00953 2E

PELICAN RIVER
Hydrologic Data for the Pelican River Sands Aquifer, Western Minnesota,
W84-00947 7C

PENNSYLVANIA
Effect of Urbanization on the Water Resources of Warminster Township, Bucks County, Pennsylvania,
W84-00774 5B

The State Water Plan, Subbasin 17, Central Allegheny River.
W84-00784 6D

The State Water Plan, Subbasin 19, Monongahela River.
W84-00785 6D

The State Water Plan, Subbasin 18, Lower Allegheny River.
W84-00786 5B

The State Water Plan, Subbasin 20, Ohio River.
W84-00787 5B

Evaluation of the Stream-flow Data in Pennsylvania,
W84-00809 7A

Subbasins 14 and 16, Genesee River and Upper Allegheny River,
W84-00838 6B

Subbasin 11, Upper Juniata River,
W84-00839 6B

Subbasin 15, Lake Erie,
W84-00840 6B

Subbasin 13, Potomac River.
W84-00841 6D

Subbasin 12, Lower Juniata River.
W84-00842 6D

State Water Plan: Subbasin 10, Lower West Branch Susquehanna River.
W84-00843 6B

State Water Plan: Subbasin 9, Central West Branch Susquehanna River.
W84-00844 6B

State Water Plan: Subbasin 8, Upper West Branch Susquehanna River.
W84-00845 5B

State Water Plan: Subbasin 7, Lower Susquehanna River.
W84-00846 6B

State Water Plan: Subbasin 6, Lower Central Susquehanna River.
W84-00847 6D

State Water Plan: Subbasin 5, Upper Central Susquehanna River.
W84-00848 6B

State Water Plan: Subbasin 4, Upper Susquehanna River.
W84-00849 6B

State Water Plan: Subbasin 1, Upper Delaware River.
W84-00850 6B

Water-Quality Assessment of Francis E. Walter Reservoir, Luzerne and Carbon Counties, Pennsylvania,
W84-01029 2H

PERENNIAL STREAM
Identification and Classification of Perennial Streams of Arkansas,
W84-01041 7C

PERFORMANCE EVALUATION
Performance Evaluation of MSF Plants, the Case of Jeddah Plants,
W84-00739 3A

Performance Study of Water Desalination Methods in Saudi Arabia,
W84-00740 3A

PERMEABILITY COEFFICIENT
Water Resources and Geology of Gloucester County, New Jersey.
W84-00798 2F

PESTICIDE TOXICITY
Groundwater Quality in New Jersey--An Investigation of Toxic Contaminants,
W84-00912 5B

Nonpoint Sources,
W84-00916 6B

PESTICIDES
Water Quality of the Barataria Marsh Unit, Jean Lafitte National Historic Park, Louisiana (April 1981-March 1982),
W84-00900 7C

PHOSPHORUS
Point Source Waste Load Allocation for the Town of Red River,
W84-00855 5G

Lake Phosphorus Loading From Septic Systems by Seasonally Perched Ground Water, Puget Sound Region, Washington,
W84-00883 5B

Computer Simulation of Phosphorus Cycling in the Sediment-Water System of Eutrophic Lakes,
W84-00964 2H

PHOTOSYNTHESIS INHIBITORS
Site Studies of Determine the Extent and Potential Impact of Herbicide Contamination in Kansas Waters,
W84-00970 5B

PHOTOVOLTAIC SYSTEM
Solar Power/Desalination, PV ED System,
W84-00737 3A

PHYTOPLANKTON
Site Studies of Determine the Extent and Potential Impact of Herbicide Contamination in Kansas Waters,
W84-00970 5B

PILOT PLANTS
Annapolis Points the Way for Fundy,
W84-00972 8A

PIPELINES
Report on Review of Water Supply Planning, Recommendations and Strategy for Western Connecticut.
W84-00911 6B

PLANNING
Historic and Prehistoric Patterns of Water Use in the Connecticut River Valley: Implications for Water Resources Planning,
W84-00968 6D

PLASMA
Ultrafiltration of Effluents from Slaughterhouses and Brine in the Meat Industry,
W84-00705 3A

POISONS
Analysis of Water Samples for Toxic Volatile Organic Compounds: State of the Art Methods and Strategies for Sampling,
W84-00851 5A

POLITICAL ASPECTS
Problems and Issues Related to Managing Water Supply and Water Quality Between North Carolina and Virginia,
W84-00961 6E

POLLUTANT IDENTIFICATION
Baseline Water-Quality Data for Sand-Plain Aquifers in Hubbard, Morrison, Otter Tail, and Wadena Counties, Minnesota,
W84-00882 7C

Specific Identification of Organic Pollutants in Haw River Water Using Gas Chromatography/Mass Spectrometry,
W84-00959 5A

Chloroform Contamination in Part of the Alluvial Aquifer, Southwest Louisville, Kentucky,
W84-01030 5B

POLLUTANTS
Status of Ground Water Quality in Logan Township, Gloucester County,
W84-00782 5B

Mercer County Stormwater Toxics Management Project: Delaware and Raritan Canal Conduit Special Study, Trenton, New Jersey.
W84-00802 5B

POLLUTION LOAD
Nonpoint Sources,
W84-00916 6B

POLYCHLORINATED BIPHENYLS
Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport,
W84-00999 5B

PORT AUTHORITIES
Prospects and Strategies for New England Ports.
W84-00908 6B

PORT FACILITIES
Prospects and Strategies for New England Ports.
W84-00908 6B

POTABLE WATER
A Tailored Process for Remineralization and Potabilization of Desalinated Water,
W84-00768 3A

POTENTIAL WATER SUPPLY
Water Information for Northwestern Missouri--A Planning Document,
W84-00810 3B

Report on Review of Water Supply Planning, Recommendations and Strategy for Western Connecticut.
W84-00911 6B

POTENTIOMETRIC LEVEL
Potentiometric Surface of the Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida, May 1982,
W84-00819 7C

Potentiometric-Surface Map of Water in the Judith River Formation in the Northern Great Plains Area of Montana,
W84-00877 7C

Potentiometric-Surface Map of Water in the Lakota Formation and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00881 7C

Potentiometric-Surface Map of Water in the Fox Hills Lower Hell Creek Aquifer in the Northern Great Plains are of Montana,
W84-00903 7C

Potentiometric-Surface Map of Water in the Eagle Sandstone and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00949 7C

Hydrogeology of the Providence Aquifer of Southwest Georgia,
W84-01031 2F

POTENTIOMETRIC LEVELS
Semiannual Water-Level and Potentiometric Contours of Two Water-Yielding Zones in the Surficial Aquifer, 1975-79, Naples, Florida,
W84-00803 7C

POTENTIOMETRIC SURFACE
Potentiometric Surface of the Floridan Aquifer in Florida, May 1980,
W84-01005 7C

POTOMAC ESTUARY STUDY
Water Quality of the Tidal River and Estuary; Hydrologic Data Report, 1981 Water Year with a Section on Chlorophyll-A: Collection and Analysis,
W84-00906 7C

POTOMAC RIVER
Water Quality of the Potomac River at Chain Bridge at Washington, D.C., Hydrologic Data Report, 1978 Water Year,
W84-00861 7C

POWERPLANTS
Development of Environmental Standards for Combined Desalination/Power Generating Stations in the Arabian Gulf Region,
W84-00744 3A

PRECIPITATION
A Hydrologic Analysis of the New Jersey Pine Barrens Region,
W84-00781 2A

PRODUCTIVITY
Water Quality of the Upper Vermilion River, Louisiana, April-August 1980,
W84-01046 5B

PROJECT PLANNING
State Water Plan: Subbasin 6, Lower Central Susquehanna River.
W84-00847 6D

Long Range Plans for Hydrologic Investigations,
W84-00852 6B

Annapolis Points the Way for Fundy,
W84-00972 8A

PUBLIC ACCESS
Harbor Management Strategies for New England,
W84-00907 6B

PUBLIC POLICY
Harbor Management Strategies for New England,
W84-00907 6B

PUBLIC SUPPLY
Consumptive Use of Freshwater in Florida, 1980,
W84-00898 7C

PUERTO RICO
Water Resources Data for Puerto Rico, 1981-82,
W84-01044 7C

PULP AND PAPER INDUSTRY
Membrane Processes for Water, Pulp and Paper, Food. State of the Art,
W84-00702 3A

Membrane Technology in the Pulp and Paper Industry,
W84-00704 3A

PUMPAGE
Determination of Irrigation Pumpage in Parts of Kearny and Finney Counties, Southwestern Kansas,
W84-00772 6D

Ground-Water Resources of Essex County, New Jersey,
W84-00797 2F

Annual Summary of Ground-Water Conditions in Arizona, Spring 1981 to Spring 1982,
W84-00824 7C

Annual Summary of Ground-Water Conditions in Arizona, Spring 1980 to Spring 1981.
W84-00941 7C

Pumpage of Water in Louisiana, 1980,
W84-00997 6D

PUMPS
Studies, Testing and Development of a Line of Brine Recirculating Pumps for Sea Water Desalination Installations,
W84-00754 3A

QUADRATIC SPLINE SUBROUTINE
Quadratic Spline Subroutine Package,
W84-00993 2A

QUALITY-ASSURANCE DATA
Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey: 1981 Annual Report,
W84-00897 5A

QUALITY CONTROL
Quality Assurance Practices for the Chemical and Physical Analyses of Water and Fluvial Sediments,
W84-00812 5A

RADIOACTIVE WASTE DISPOSAL
Geologic and Well-Construction Data for the H-10 Borehole Complex Near the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico,
W84-00901 5E

RADIOACTIVE WASTES
The Puerco River: Muddy Issues Raised by a Mine Water Dominated Ephemeral Stream,
W84-00853 5B

Removing Uranium From Drinking Water Supplies: Demonstration of Selected Ion Exchange and Chemical Clarification,
W84-00857 5F

RAINFALL HYDROGRAPH
Annual Snowmelt and Rainfall Peak-Flow Data on Selected Foothills Region Streams, South Platte River Arkansas River, and Colorado River Basins, Colorado,
W84-01038 7C

RAINFALL-RUNOFF MODEL
Magnitude and Frequency of Flooding on Small Urban Watersheds in the Tampa Bay Area, West-Central Florida,
W84-00994 2A

RAINFALL-RUNOFF RELATIONSHIPS
Rainfall-Runoff Data From Small Watersheds in Colorado, October 1977 Through September 1980,
W84-00858 7C

Hydrologic Data for Urban Storm Runoff in the Denver Metropolitan Area, Colorado,
W84-00859 7C

RAW WASTEWATER
The State Water Plan, Subbasin 18, Lower Allegheny River.
W84-00786 5B

RECHARGE
Ground Water Resources in Fayoum Area, Egypt,
W84-00747 3A

A Natural Resource and Land Use Analysis of the Lacona Williamstown Portion of the Tug Hill Aquifer.
W84-00913 2F

RECLAMATION
Potential Effects of Surface Coal Mining on the Hydrology of the Cook Creek Area, Ashland Coal Field, Southeastern Montana,
W84-00899 4C

Hydrologic Effects of Storing Liquified Sewage Sludge on Strip-Mined Land in Fulton County, Illinois,
W84-00977 5E

RED RIVER OF THE NORTH
Changes in Flood Response of the Red River of the North Basin, North Dakota-Minnesota,
W84-01020 4C

REGIONAL ANALYSIS
Semi-Variogram Estimation and Universal Kriging Program (Computer Program Documentation, User's Manual),
W84-00829 7C

Estimating Peak Discharges of Small Rural Streams in Massachusetts,
W84-00990 2E

Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan,
W84-01008 2F

REGIONAL AQUIFER SYSTEM
Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan,
W84-01008 2F

REGIONAL FLOOD
Magnitude and Frequency of Flooding on Small Urban Watersheds in the Tampa Bay Area, West-Central Florida,
W84-00994 2A

REGIONAL FLOODS
Floods of December 1982 and January 1983 in Central and Southern Mississippi River Basin,
W84-00886 7C

REGIONAL PLANNING
Prospects and Strategies for New England Ports.
W84-00908 6B

REGULATED FLOW
Floods of November 1978 to March 1979 in Arizona and West-Central New Mexico,
W84-00837 7C

Floods of October 1977 in Southern Arizona and March 1978 in Central Arizona,
W84-00953 2E

REGULATION
Report of the River Master of the Delaware River for the Period December 1, 1980-November 30, 1981,
W84-01040 3D

RELIABILITY
Reliability of the Jeddah Seawater RO Desalination Plant Based Upon Operations Experience,
W84-00738 3A

RESERVE OSMOSIS SYSTEM
Membrane Technology in the Pulp and Paper Industry,
W84-00704 3A

RESERVOIR RELEASES
Localized Destratification at Lake Texoma,
W84-00956 5G

RESERVOIR RIGHT
Legal Aspects of Stored Water in Federal Reservoirs in Kansas,
W84-00971 6E

RESERVOIR STORAGE
Floods of November 1978 to March 1979 in Arizona and West-Central New Mexico,
W84-00837 7C

Floods of October 1977 in Southern Arizona and March 1978 in Central Arizona,
W84-00953 2E

Reservoir-Development Impacts on Surface-Water Quantity and Quality in the Yampa River Basin, Colorado and Wyoming,
W84-01042 4C

RESERVOIR STORAGE RIGHT
Legal Aspects of Stored Water in Federal Reservoirs in Kansas,
W84-00971 6E

RESERVOIRS
Subbasin 13, Potomac River.
W84-00841 6D

RESIDUAL TURBIDITY
An Evaluation of Suspended Sediment and Turbidity in Cow Creek, Oregon,
W84-00939 2J

REVERSE OSMOSIS
Conceptual Design Aspects of Reverse Osmosis,
W84-00703 3A

Membrane Technology and Biotechnology,
W84-00707 3A

Membrane Technology Applied to Bioconversion of Macromolecular Substrates and Upgrading of Products. A Model Study on Ethanol Production from Cellulose,
W84-00709 3A

Preconcentration by Reverse Osmosis Before Evaporation - Possibilities in Sweden,
W84-00714 3A

Today's Status of pH Measurement and Control in Desalination Plants,
W84-00718 3A

Waste Heat Powered Reverse Osmosis Plants,
W84-00731 3A

Reliability of the Jeddah Seawater RO Desalination Plant Based Upon Operations Experience,
W84-00738 3A

Experiments with Desalination of Arabian Gulf Water,
W84-00745 3A

Operating Experience on Ro Sea Water Desalination Plant at Chigasaki Laboratory,
W84-00759 3A

Advanced Treatment of Secondary Sewage Effluent by Membrane Process,
W84-00760 5D

RIVER BASINS
State Water Plan: Subbasin 9, Central West Branch Susquehanna River.
W84-00844 6B

State Water Plan: Subbasin 8, Upper West Branch Susquehanna River.
W84-00845 5B

State Water Plan: Subbasin 7, Lower Susquehanna River.
W84-00846 6B

State Water Plan: Subbasin 6, Lower Central Susquehanna River.
W84-00847 6D

State Water Plan: Subbasin 4, Upper Susquehanna River.
W84-00849 6B

RIVER BASINS, *STREAM POLLUTION
State Water Plan: Subbasin 10, Lower West Branch Susquehanna River.
W84-00843 6B

RIVER MILES
Drainage Areas of the Kanawha River Basin,
W84-00948 7C

RIVER-QUALITY-ASSESSMENT PROJECT
Annotated Report and Data Inventory for the Mississippi River Quality-Assessment, Minneapolis-St. Paul Metropolitan Area,
W84-00860 10C

RIVERBEDS
Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport,
W84-00999 5B

RIVERS
The State Water Plan, Subbasin 19, Monongahela River.
W84-00785 6D

The State Water Plan, Subbasin 20, Ohio River.
W84-00787 5B

Subbasins 14 and 16, Genesee River and Upper Allegheny River,
W84-00838 6B

Subbasin 13, Potomac River.
W84-00841 6D

Subbasin 12, Lower Juniata River.
W84-00842 6D

State Water Plan: Subbasin 5, Upper Central Susquehanna River.
W84-00848 6B

State Water Plan: Subbasin 1, Upper Delaware River.
W84-00850 6B

Specific Identification of Organic Pollutants in Haw River Water Using Gas Chromatography/Mass Spectrometry,
W84-00959 5A

RIYADH
The Riyadh Water Transmission System (RWTS),
W84-00743 3A

RUNNING WATERS
Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

SAFE YIELD
Report on Review of Water Supply Planning, Recommendations and Strategy for Western Connecticut.
W84-00911 6B

SALINE WATER INTRUSION
Hydrologic Data From Monitoring of Saline-Water Intrusion in the Cape Coral Area, Lee County, Florida,
W84-00935 7C

SALINE WATER INTRUSION

Potential Hydrologic Impacts of Ground-Water Withdrawals from the Cape Cod National Seashore, Truro, Massachusetts,
W84-00944 2F

Appraisal of the Interconnection between the St. Johns River and the Surficial Aquifer, East Central Duval County, Florida,
W84-00975 6G

Premining Hydrology of the Lignite Area in Southeastern De Soto Parish, Louisiana,
W84-01006 4C

Assessment of the Interconnection Between Tampa Bay and the Floridan Aquifer, Florida,
W84-01019 2F

SALT VALLEY ANTICLINE

Results of Hydraulic Tests in U.S. Department of Energy's Wells Doe-4, 5, 6, 7, 8 and 9, Salt Valley, Grand County, Utah,
W84-01039 2F

SALTWATER INTRUSION

Hydrology, Water Quality, and Biology of Baptiste Collette Bayou in Relation to the Mississippi River at Venice, Louisiana,
W84-01025 5B

SAND

A Natural Resource and Land Use Analysis of the Lacona Williamstown Portion of the Tug Hill Aquifer.
W84-00913 2F

SAND AQUIFERS

A Natural Resource and Land Use Analysis of the Lacona Williamstown Portion of the Tug Hill Aquifer.
W84-00913 2F

SANDSTONE AQUIFERS

Geohydrologic Data from Sandstone Aquifers in Southwestern Kansas,
W84-00864 7C

SANTA FE RIVER BASIN

Water Resources of the Santa Fe River Basin, Florida,
W84-01013 2F

SAUDI ARABIA

Performance Study of Water Desalination Methods in Saudi Arabia,
W84-00740 3A

The Riyadh Water Transmission System (RWTS),
W84-00743 3A

SEDIMENT

Streamflow and Sediment Transport in the Quillayute River Basin, Washington,
W84-00920 2J

Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport,
W84-00999 5B

SEDIMENT DISCHARGE

Streamflow and Suspended-Sediment Transport in Garvin Brook, Winona County, Southeastern Minnesota Hydrologic Data for 1982,
W84-00832 2J

Microcomputer Computation of Water Quality Discharges,
W84-00985 2J

Erosion and Sediment Characteristics of the Southeastern Uinta Basin, Utah and Colcrado,
W84-01036 2J

SEDIMENT DISTRIBUTION

Sediment and Stream-Velocity Data for the Sacramento River Near Hood, California, May 1978 to September 1981,
W84-01003 7C

SEDIMENT LOAD

Streamflow and Suspended-Sediment Transport in Garvin Brook, Winona County, Southeastern Minnesota Hydrologic Data for 1982,
W84-00832 2J

Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming: Part III. River Hydraulics and Sediment Transport, 1980,
W84-00937 7C

SEDIMENT TRANSPORT

Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming, Part IV. Bed Elevations, 1980,
W84-00936 7C

Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming: Part III. River Hydraulics and Sediment Transport, 1980,
W84-00937 7C

An Evaluation of Suspended Sediment and Turbidity in Cow Creek, Oregon,
W84-00939 2J

SEDIMENT YIELD

Subbasin 12, Lower Juniata River.
W84-00842 6D

State Water Plan: Subbasin 10, Lower West Branch Susquehanna River.
W84-00843 6B

Streamflow and Sediment Transport in the Quillayute River Basin, Washington,
W84-00920 2J

Erosion and Sediment Characteristics of the Southeastern Uinta Basin, Utah and Colorado,
W84-01036 2J

SEDIMENTATION

Removing Uranium From Drinking Water Supplies: Demonstration of Selected Ion Exchange and Chemical Clarification,
W84-00857 5F

SEDIMENTS

Ground-Water Resources of Essex County, New Jersey,
W84-00797 2F

An Evaluation of Suspended Sediment and Turbidity in Cow Creek, Oregon,
W84-00939 2J

SEISMIC STUDIES

Continuous Seismic-Reflection Survey Defining Shallow Sedimentary Layers in the Charlotte Harbor and Venice Areas, Southwest, Florida,
W84-00929 2F

SEPARATION TECHNIQUES

Removal of Refractory Organics from Water by Aeration. II. Solvent Sublation of Methylene Blue and Methyl Orange,
W84-00954 5F

SEPTIC TANKS

State Water Plan: Subbasin 10, Lower West Branch Susquehanna River.
W84-00843 6B

Lake Phosphorus Loading From Septic Systems by Seasonally Perched Ground Water, Puget Sound Region, Washington,
W84-00883 5B

SEPTIC WASTEWATER

State Water Plan: Subbasin 10, Lower West Branch Susquehanna River.
W84-00843 6B

SEWAGE SLUDGE

Hydrologic Effects of Storing Liquified Sewage Sludge on Strip-Mined Land in Fulton County, Illinois,
W84-00977 5E

SHALLOW AQUIFERS

Potential Effects of Surface Coal Mining on the Hydrology of the Cook Creek Area, Ashland Coal Field, Southeastern Montana,
W84-00899 4C

SHELLFISH

A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River,
W84-00909 5C

SIMULATION ANALYSIS

Procedures for Assessment of Cumulative Impacts of Coal Mining on the Hydrologic Balance,
W84-00780 4C

SINKHOLES

Hydrology of the Hamilton Lakes and Vicinity, Polk County, Central Florida,
W84-00905 7C

SLOPE-AREA MEASUREMENT

Annual Water-Resources Review, white Sands Missile Range, New Mexico, 1981,
W84-00872 2F

SMALL WATERSHEDS

Effects of Urbanization on the Magnitude and Frequency of Floods on Small Streams in Tennessee-Basic Data Report No. 2,
W84-00826 4C

Rainfall-Runoff Data From Small Watersheds in Colorado, October 1977 Through September 1980,
W84-00858 7C

Reconnaissance of Stormwater-Runoff Water Quality of the Big Piney Creek Segment of the Cedar-Piney Watershed, Yell County, Arkansas,
W84-00933 5B

Quality of Runoff From Small Watersheds in the Twin Cities Metropolitan Area, Minnesota--Hydrologic Data for 1980,
W84-00982 7C

Small-Stream Flood Investigations in Minnesota, October 1958 to September 1980,
W84-01033 7C

SNOWMELT HYDROGRAPH

Annual Snowmelt and Rainfall Peak-Flow Data on Selected Foothills Region Streams, South Platte River Arkansas River, and Colorado River Basins, Colorado,
W84-01038 7C

SOIL CLASSIFICATION

A Natural Resource and Land Use Analysis of the Lacona Williamstown Portion of the Tug Hill Aquifer.
W84-00913 2F

SOIL EROSION

Subbasin 12, Lower Juniata River.
W84-00842 6D

SOIL MOISTURE

Determination of Irrigation Pumpage in Parts of Kearny and Finney Counties, Southwestern Kansas,
W84-00772 6D

SOIL MOISTURE PROFILES
Mathematical Models of Soil Moisture Profiles Using Two-Phase Flow Theory,
W84-00966 2G

SOIL WATER
Mathematical Models of Soil Moisture Profiles Using Two-Phase Flow Theory,
W84-00966 2G

Hydraulic Considerations in Sampling the Unsaturated Zone with Inclined Gravity Lysimeters,
W84-01018 2G

SOLAR DISTILLATION
Test Results from a Solar Boiler for Saline Water Distillation,
W84-00724 3A

Solar Distillation: The Solar-Driven Case,
W84-00726 3A

Design and Operation Experience with Solar Powered Multistage Desalination Plants,
W84-00728 3A

Development of Solar Desal, A Code for Modeling, Simulation and Design of Solar Desalination Systems,
W84-00734 3A

SOLAR ENERGY
An Assessment of the Market Potential for Small Solar Powered Desalination Plants,
W84-00722 3A

Comparison of Solar RO and Solar Thermal Desalination Systems,
W84-00727 3A

Engineering Design of a 6000 cu m/Day Seawater Hybrid RO-ED Helio-Desalting,
W84-00735 3A

Desalination and Renewable Energies - A Few Recent Developments,
W84-00755 3A

SOLAR MULTI-EFFECT DISTILLATION
Solar Desalination: Prototype 'Pithon' A Special Solar Multiple-Effect Distiller,
W84-00729 3A

SOLAR PUMPS
Integrating Intermittent and Renewable Power Resources into the Hydropower system of the Pacific Northwest,
W84-00958 6A

SOLAR STILLS
Development of a Marine Osmotic Solar Still for a Sea Water Desalination,
W84-00736 3A

SOLAR WATER HEATERS
Integrating Intermittent and Renewable Power Resources into the Hydropower system of the Pacific Northwest,
W84-00958 6A

SOLID WASTE
Water-Quality Reconnaisance of the North Data County Solid-Waste Disposal Facility, Florida,
W84-00874 5B

SOUTH DAKOTA
Water-Resources Investigations of the U.S. Geological Survey in South Dakota,
W84-00827 7A

Major Aquifers in Hanson and Davison Counties, South Dakota,
W84-00978 2F

Major Aquifers in Yankton County, South Dakota,
W84-00979 2F

SOUTH PLATTE RIVER BASIN
Annual Snowmelt and Rainfall Peak-Flow Data on Selected Foothills Region Streams, South Platte River Arkansas River, and Colorado River Basins, Colorado,
W84-01038 7C

SOUTHEAST U.S
Predevelopment Flow in the Tertiary Limestone Aquifer, Southeastern United States: A Regional Analysis From Digital Modeling,
W84-00884 2F

Groundwater Management in the Southeast,
W84-00955 4B

SPRING TIDES
Graphical Method for Estimating Occurrence and Duration of a Critical Low Flow in the Sacramento River at Freeport, California,
W84-00973 5G

STAGE DISCHARGE RELATIONS
Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge,
W84-01048 7B

Measurement and Computation of Streamflow: Volume 2. Computation of Discharge,
W84-01049 2E

STATE JURISDICTION
State Water Plan: Subbasin 5, Upper Central Susquehanna River.
W84-00848 6B

State Water Plan: Subbasin 1, Upper Delaware River.
W84-00850 6B

The Puerco River: Muddy Issues Raised by a Mine Water Dominated Ephemeral Stream,
W84-00853 5B

Groundwater Management in the Southeast,
W84-00955 4B

STATISTICAL ANALYSIS
Reconnaissance for Determining Effects of Land Use and Surficial Geology on Concentrations of Selected Elements on Streambed Materials from the Coal Mining, Region, Southwestern Indiana, October 1979 to March 1980,
W84-00771 5B

Statistical Summaries of New Jersey Streamflow Records,
W84-00800 7C

Statistical Summaries of Selected Chemical Constituents in Kansas Ground-Water Supplies,
W84-00869 2F

STATISTICAL ESTIMATING ANALYSIS
Semi-Variogram Estimation and Universal Kriging Program (Computer Program Documentation, User's Manual),
W84-00829 7C

STEEL
Operational Experience of 2 x 11,500 m super 3 d Msf Seawater Desalination Plant,
W84-00741 3A

STORAGE RIGHT
Legal Aspects of Stored Water in Federal Reservoirs in Kansas,
W84-00971 6E

STORM RUNOFF
Mercer County Stormwater Toxics Management Project: Delaware and Raritan Canal Conduit Special Study, Trenton, New Jersey.
W84-00802 5B

Hydrologic Data for Urban Storm Runoff in the Denver Metropolitan Area, Colorado,
W84-00859 7C

Reconnaissance of Stormwater-Runoff Water Quality of the Big Piney Creek Segment of the Cedar-Piney Watershed, Yell County, Arkansas,
W84-00933 5B

Quality of Runoff From Small Watersheds in the Twin Cities Metropolitan Area, Minnesota--Hydrologic Data for 1980,
W84-00982 7C

STORM SEWERS
Mercer County Stormwater Toxics Management Project: Delaware and Raritan Canal Conduit Special Study, Trenton, New Jersey.
W84-00802 5B

STRATIGRAPHY
Generalized Configuration of the Top of the Limestone Unit of the Lower Part of the Surficial Aquifer, Duval County, Florida,
W84-01037 7C

STREAM DISCHARGE
Statistical Summaries of New Jersey Streamflow Records,
W84-00800 7C

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1982 Water Year,
W84-00891 7C

STREAM-GAGE CONTROLS
Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge,
W84-01048 7B

Measurement and Computation of Streamflow: Volume 2. Computation of Discharge,
W84-01049 2E

STREAM GAGES
Statistical Summaries of New Jersey Streamflow Records,
W84-00800 7C

Monthly Low-Flow Characteristics of Georgia Streams,
W84-00923 7C

STREAM IMPROVEMENT
The State Water Plan, Subbasin 19, Monongahela River.
W84-00785 6D

The State Water Plan, Subbasin 20, Ohio River.
W84-00787 5B

What is the Condition of Our Surface Water.,
W84-00919 5G

STREAM POLLUTION
The State Water Plan, Subbasin 19, Monongahela River.
W84-00785 6D

The State Water Plan, Subbasin 20, Ohio River.
W84-00787 5B

Stream Surveillance and Analysis: Shabakunk Creek and Little Bear Brook Watersheds,
W84-00801 5B

Subbasin 13, Potomac River.
W84-00841 6D

State Water Plan: Subbasin 9, Central West Branch Susquehanna River.
W84-00844 6B

State Water Plan: Subbasin 8, Upper West Branch Susquehanna River.
W84-00845 5B

State Water Plan: Subbasin 5, Upper Central Susquehanna River.
W84-00848 6B

STREAM POLLUTION

State Water Plan: Subbasin 4, Upper Susquehanna River.
W84-00849 6B

State Water Plan: Subbasin 1, Upper Delaware River.
W84-00850 6B

What is the Condition of Our Surface Water.,
W84-00919 5G

STREAM VELOCITY DATA

Sediment and Stream-Velocity Data for the Sacramento River Near Hood, California, May 1978 to September 1981,
W84-01003 7C

STREAMFLOW

Streamflow and Suspended-Sediment Transport in Garvin Brook, Winona County, Southeastern Minnesota Hydrologic Data for 1982,
W84-00832 2J

Discharge Data at Water-Quality Monitoring Stations in Arkansas, 1980 Water Year,
W84-00887 7C

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1982 Water Year,
W84-00891 7C

Monthly Low-Flow Characteristics of Georgia Streams,
W84-00923 7C

Water Resources of the Santa Fe River Basin, Florida,
W84-01013 2F

STREAMFLOW STATISTICS

Water Information for Northwestern Missouri--A Planning Document,
W84-00810 3B

STRIP MINE WASTES

The State Water Plan, Subbasin 17, Central Allegheny River.
W84-00784 6D

Premining Hydrology of the Lignite Area in Southeastern De Soto Parish, Louisiana,
W84-01006 4C

SUBSIDENCE

Land Subsidence in the San Joaquin Valley, California, as of 1980,
W84-00932 4B

SUDAN

Origin of Subsurface Water in Khartoum Province, Sudan,
W84-00748 3A

SURFACE-GROUNDWATER RELATIONS

Long Range Plans for Hydrologic Investigations,
W84-00852 6B

Ground Water: A Non-Technical Guide,
W84-00915 2F

SURFACE-GROUNDWATER RELATIONSHIP

Appraisal of the Interconnection between the St. Johns River and the Surficial Aquifer, East Central Duval County, Florida,
W84-00975 6G

SURFACE/GROUNDWATER RELATIONSHIPS

Evaluation of Water-Quality Characteristics of Part of the Spokane Aquifer, Washington and Idaho, Using a Solute-Transport Digital Model,
W84-01001 2F

Ground Water-Surface Water Relationships in the Bonaparte Creek Basin, Okanogan County, Washington 1979-80,
W84-01017 2A

SURFACE RESISTIVITY

Hydrogeologic Features of the Alluvial Deposits in the Owl Creek Valley, Bighorn Basin, Wyoming,
W84-00770 2F

SURFACE RUNOFF

Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

SURFACE WATER

A Hydrologic Analysis of the New Jersey Pine Barrens Region,
W84-00781 2A

The State Water Plan, Subbasin 17, Central Allegheny River.
W84-00784 6D

The State Water Plan, Subbasin 18, Lower Allegheny River.
W84-00786 5B

The State Water Plan, Subbasin 20, Ohio River.
W84-00787 5B

Subbasin 12, Lower Juniata River.
W84-00842 6D

Drainage Divides, Massachusetts--Taunton River Basin and Southeast Coastal Basins,
W84-00868 7C

What is the Condition of Our Surface Water.,
W84-00919 5G

Water Resources Data, North Carolina, Water Year 1982,
W84-01028 7C

Hydrology of Area 49, Northern Great Plains and Rocky Mountain Coal Provinces, Montana and Wyoming,
W84-01043 2A

Water Resources Data for Puerto Rico, 1981-82,
W84-01044 7C

SURFACE WATER RESOURCES

Water Resources of Manatee County Florida,
W84-01026 2F

SURFACE WATERS

Drainage Divides, Massachusetts--Connecticut River Lowlands and Chicopee River Basin,
W84-00902 7C

SURFACTANTS

Removal of Refractory Organics from Water by Aeration. II. Solvent Sublation of Methylene Blue and Methyl Orange,
W84-00954 5F

SURFICIAL AQUIFER

Appraisal of the Interconnection between the St. Johns River and the Surficial Aquifer, East Central Duval County, Florida,
W84-00975 6G

SURFICIAL GEOLOGY

Hydrogeologic Features of the Alluvial Deposits in the Owl Creek Valley, Bighorn Basin, Wyoming,
W84-00770 2F

SURVEYS

Analysis of Water Samples for Toxic Volatile Organic Compounds: State of the Art Methods and Strategies for Sampling,
W84-00851 5A

Long Range Plans for Hydrologic Investigations,
W84-00852 6B

Hydrocarbon Fuels in Ground Water--Increased Awareness and Concern in New Mexico,
W84-00854 5B

Point Source Waste Load Allocation for the Town of Red River,
W84-00855 5G

SUSPENDED SEDIMENTS

Premining Hydrology of the Lignite Area in Southeastern De Soto Parish, Louisiana,
W84-01006 4C

Water-Quality and Fluvial-Sediment Characteristics of Selected Streams in Northeast Kansas,
W84-01045 2J

SUSPENDED SOLIDS

Subbasins 14 and 16, Genesee River and Upper Allegheny River,
W84-00838 6B

SWEDEN

Closing Remarks,
W84-00715 3A

TEMPERATURE GRADIENT

Ocean Thermal Energy and Desalination,
W84-00733 3A

TENNESSEE

Effects of Urbanization on the Magnitude and Frequency of Floods on Small Streams in Tennessee-Basic Data Report No. 2,
W84-00826 4C

Cane Creek Flood-Flow Characteristics at State Route 30 Near Spencer, Tennessee,
W84-00871 4C

Results of Pesticide Sampling in Tennessee,
W84-00889 7C

TERRACES

Hydrogeologic Features of the Alluvial Deposits in the Owl Creek Valley, Bighorn Basin, Wyoming,
W84-00770 2F

TEXAS

Approximate Altitude of Water Levels in Wells in the Chicot and Evangeline Aquifers in the Houston Area, Texas, Spring 1982,
W84-00922 7C

Localized Destratification at Lake Texoma,
W84-00956 5G

Effects of Ground-Water Development in the North Fort Hood Area, Coryell County, Texas,
W84-01032 2F

THERMAL POLLUTION

Subbasin 11, Upper Juniata River,
W84-00839 6B

State Water Plan: Subbasin 8, Upper West Branch Susquehanna River.
W84-00845 5B

THERMAL POWER

Ocean Thermal Energy and Desalination,
W84-00733 3A

TIDAL ENERGY

Annapolis Points the Way for Fundy,
W84-00972 8A

TIDAL POTOMAC RIVER

Water Quality of the Tidal River and Estuary; Hydrologic Data Report, 1981 Water Year with a Section on Chlorophyll-A: Collection and Analysis,
W84-00906 7C

TIDAL POWERPLANTS

Annapolis Points the Way for Fundy,
W84-00972 8A

TIME-OF-TRAVEL

Time of Travel of Selected Arkansas Streams,
W84-00895 2E

TIME-SERIES ANALYSIS
Determination of Ultimate Carbonaceous BOD and the Specific Rate Constant (K sub 1),
W84-00805 5A

TIME TREND ANALYSES
Water-Quality Assessment of the American River, California,
W84-00828 5B

TOXICANT RESISTANCE
Site Studies of Determine the Extent and Potential Impact of Herbicide Contamination in Kansas Waters,
W84-00970 5B

TOXICITY
Analysis of Water Samples for Toxic Volatile Organic Compounds: State of the Art Methods and Strategies for Sampling,
W84-00851 5A

TRACE ELEMENTS
Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey: 1981 Annual Report,
W84-00897 5A

TRACE METALS
Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey: 1981 Annual Report,
W84-00897 5A

Hydrology, Water Quality, and Biology of Baptiste Collette Bayou in Relation to the Mississippi River at Venice, Louisiana,
W84-01025 5B

TRAINING
Education and Training in Desalination Around the World,
W84-00764 3A

A New Idea for Training Operators,
W84-00765 3A

Activities in Idaho, Status of Projects, Fiscal Years 1982-83.
W84-00835 9D

TRANSMISSIVITY
Results of Hydraulic Tests in U.S. Department of Energy's Wells Doe-4, 5, 6, 7, 8 and 9, Salt Valley, Grand County, Utah,
W84-01039 2F

TREES
Wetland Hydrology and Tree Distribution of the Apalachicola River Flood Plain, Florida,
W84-00813 2I

TROPHIC LEVEL
Limnological Characteristics of Wisconsin Lakes,
W84-00794 2H

TURBIDITY
An Evaluation of Suspended Sediment and Turbidity in Cow Creek, Oregon,
W84-00939 2J

TURBINES
The Application of Pelton Type Impulse Turbines for Energy Recovery on Sea Water Reverse Osmosis Systems,
W84-00762 3A

U.S. GEOLOGICAL SURVEY
Indentification Codes for Organizations Listed in Computerized Data Systems of the U.S. Geological Survey,
W84-00817 10D

ULTIMATE BIOCHEMICAL OXYGEN DEMAND
Determination of Ultimate Carbonaceous BOD and the Specific Rate Constant (K sub 1),
W84-00805 5A

ULTRAFILTRATION
Utilization of the New Mineral UF Membranes for Making Semi-hard Cheeses,
W84-00701 3A

Ultrafiltration of Effluents from Slaughterhouses and Brine in the Meat Industry,
W84-00705 3A

Membrane Technology and Biotechnology,
W84-00707 3A

System Options and Costs in Dairy Ultrafiltration,
W84-00712 3A

Advanced Treatment of Secondary Sewage Effluent by Membrane Process,
W84-00760 5D

UNCONFINED AQUIFER
Land Subsidence in the San Joaquin Valley, California, as of 1980,
W84-00932 4B

UNCONFINED AQUIFERS
Use of a Three-Dimensional Model for the Analysis of the Ground-Water Flow System in Parker Valley, Arizona and California,
W84-00823 2F

UNCONSOLIDATED AQUIFERS
Ground-Water Resources of Essex County, New Jersey,
W84-00797 2F

UNDERGROUND WASTE DISPOSAL
Data on Subsurface Storage of Liquid Waste Near Pensacola, Florida, 1963-1980,
W84-00951 7C

UNSATURATED ZONE
Hydraulic Considerations in Sampling the Unsaturated Zone with Inclined Gravity Lysimeters,
W84-01018 2G

URANIUM
The Puerco River: Muddy Issues Raised by a Mine Water Dominated Ephemeral Stream,
W84-00853 5B

Removing Uranium From Drinking Water Supplies: Demonstration of Selected Ion Exchange and Chemical Clarification,
W84-00857 5F

URBAN RUNOFF
Mercer County Stormwater Toxics Management Project: Delaware and Raritan Canal Conduit Special Study, Trenton, New Jersey.
W84-00802 5B

Water-Quality Assessment of the American River, California,
W84-00828 5B

Subbasin 15, Lake Erie,
W84-00840 6B

Hydrologic Data for Urban Storm Runoff in the Denver Metropolitan Area, Colorado,
W84-00859 7C

Techniques for Estimating Flood Hydrographs for Ungaged Urban Watersheds,
W84-00940 2E

Quality of Runoff From Small Watersheds in the Twin Cities Metropolitan Area, Minnesota--Hydrologic Data for 1980,
W84-00982 7C

Magnitude and Frequency of Flooding on Small Urban Watersheds in the Tampa Bay Area, West-Central Florida,
W84-00994 2A

URBAN WATERSHEDS
Techniques for Estimating Flood Hydrographs for Ungaged Urban Watersheds,
W84-00940 2E

URBANIZATION
Effect of Urbanization on the Water Resources of Warminster Township, Bucks County, Pennsylvania,
W84-00774 5B

UTAH
Selected Hydrologic Data, 1978-80, Price River Basin, Utah,
W84-00825 7C

Hydrology of Coal-Resource Areas in the Southern Wasatch Plateau, Central Utah,
W84-00893 2A

Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan,
W84-01008 2F

Hydrology of the Beryl-Enterprise Area, Escalante Desert, Utah, with Emphasis on Ground Water,
W84-01024 2F

Erosion and Sediment Characteristics of the Southeastern Uinta Basin, Utah and Colorado,
W84-01036 2J

Results of Hydraulic Tests in U.S. Department of Energy's Wells Doe-4, 5, 6, 7, 8 and 9, Salt Valley, Grand County, Utah,
W84-01039 2F

VAPOR PRESSURE
Analysis of Water Samples for Toxic Volatile Organic Compounds: State of the Art Methods and Strategies for Sampling,
W84-00851 5A

VARIOGRAM
Semi-Variogram Estimation and Universal Kriging Program (Computer Program Documentation, User's Manual),
W84-00829 7C

VELOCITY
Time of Travel of Selected Arkansas Streams,
W84-00895 2E

VOLATILE SOLIDS
Analysis of Water Samples for Toxic Volatile Organic Compounds: State of the Art Methods and Strategies for Sampling,
W84-00851 5A

WASHINGTON
Preliminary Survey of Ground-Water Resources for Island County, Washington,
W84-00878 2F

Lake Phosphorus Loading From Septic Systems by Seasonally Perched Ground Water, Puget Sound Region, Washington,
W84-00883 5B

Streamflow and Sediment Transport in the Quillayute River Basin, Washington,
W84-00920 2J

An Engineering Economic Analysis of Artificial Recharge in a Conjunctive Irrigation Plan in the Columbia Basin Project, Washington,
W84-00989 4B

Evaluation of Water-Quality Characteristics of Part of the Spokane Aquifer, Washington and Idaho, Using a Solute-Transport Digital Model,
W84-01001 2F

Numerical Simulation of Ground-Water Flow in the Lower Satus Creek Basin, Yakima Indian Reservation, Washington,
W84-01010 4B

Impact of Changes in Land Use on the Ground-Water System in The Sequim-Dungeness Peninsula, Clallam County, Washington,
W84-01014 4C

General Hydrology and External Sources of Nutrients Affecting Pine Lake, King County, Washington,
W84-01015 2H

Ground Water-Surface Water Relationships in the Bonaparte Creek Basin, Okanogan County, Washington 1979-80,
W84-01017 2A

WASTE DISPOSAL
Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

WASTE HEAT
Waste Heat Powered Reverse Osmosis Plants,
W84-00731 3A

Usability of Low Temperature Waste Heat for Sea Water Desalination,
W84-00732 3A

WASTE ISOLATION PILOT PLANT
Geologic and Well-Construction Data for the H-10 Borehole Complex Near the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico,
W84-00901 5E

WASTE LOAD
Point Source Waste Load Allocation for the Town of Red River,
W84-00855 5G

WASTE POLLUTION CONTROL
The State Water Plan, Subbasin 19, Monongahela River.
W84-00785 6D

WASTEWATER IRRIGATION
Health and Safety Aspects of Irrigation of Raw-Eaten Food Crops with Reused Water,
W84-00767 5D

WASTEWATER REUSE
Advance in Water Quality Monitoring and the Use of Firefly Luciferine/Luciferase Atp Bioassay,
W84-00769 5D

WASTEWATER TREATMENT
Determination of Ultimate Carbonaceous BOD and the Specific Rate Constant (K sub 1),
W84-00805 5A

Point Source Waste Load Allocation for the Town of Red River,
W84-00855 5G

WATER ALLOCATION
State Water Plan: Subbasin 7, Lower Susquehanna River.
W84-00846 6B

WATER ANALYSIS
Quality Assurance Practices for the Chemical and Physical Analyses of Water and Fluvial Sediments,
W84-00812 5A

Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey: 1981 Annual Report,
W84-00897 5A

Water Quality Monitoring - Rivers and Streams, 1982.
W84-00910 7C

Water-Quality and Fluvial-Sediment Characteristics of Selected Streams in Northeast Kansas,
W84-01045 2J

WATER CONSERVATION
Evaluating the Effectiveness of Promoting Residential Water Conservation through Exhibits,
W84-00963 3D

WATER DATA SITES
Definitions of Components of the Master Water Data Index Maintained by the National Water Data Exchange,
W84-00778 10A

WATER DEFICIT
Report on Review of Water Supply Planning, Recommendations and Strategy for Western Connecticut.
W84-00911 6B

WATER DEMAND
Activities in Spain,
W84-00757 3A

Morris County Master Plan: Water Supply Element.
W84-00788 6D

State Water Plan: Subbasin 1, Upper Delaware River.
W84-00850 6B

WATER DISTRIBUTION
The Riyadh Water Transmission System (RWTS),
W84-00743 3A

WATER LAW
Interstate Water Law Issues: Unilateral State Legislation, Original Suits in the Supreme Court, Interstate Compacts,
W84-00960 6E

WATER-LEVEL CHANGES
January 1982 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W84-00981 7C

WATER-LEVEL CONTOURS
Geohydrology of the High Plains Aquifer System in Nebraska,
W84-01002 7C

WATER-LEVEL DECLINES
Geohydrology of the High Plains Aquifer System in Nebraska,
W84-01002 7C

Effects of Ground-Water Development in the North Fort Hood Area, Coryell County, Texas,
W84-01032 2F

WATER LEVEL FLUCTUATIONS
Semiannual Water-Level and Potentiometric Contours of Two Water-Yielding Zones in the Surficial Aquifer, 1975-79, Naples, Florida,
W84-00803 7C

Annual Summary of Ground-Water Conditions in Arizona, Spring 1981 to Spring 1982,
W84-00824 7C

Hydrographs of Water Levels in Observation Wells in Idaho, 1971-82,
W84-00831 7C

Approximate Altitude of Water Levels in Wells in the Chicot and Evangeline Aquifers in the Houston Area, Texas, Spring 1982,
W84-00922 7C

Data for Ground-Water Test Hole near Zamora, Central Valley Aquifer Project, California,
W84-00927 7C

Annual Summary of Ground-Water Conditions in Arizona, Spring 1980 to Spring 1981.
W84-00941 7C

Ground-Water Data for Georgia, 1981,
W84-00986 7C

Trends in Ground-Water Levels in Wisconsin Through 1981,
W84-01047 7C

WATER-LEVEL HYDROGRAPHS
Map of the Antelope Valley-East Kern Water Agency Area, California, Showing Ground-Water Subunits and Areas, and Well Hydrographs, 1962 to 1982,
W84-00820 7C

WATER LEVELS
Map Showing Groundwater Conditions in the Tonto Basin Area, Gila County, Arizona--1979,
W84-00807 7C

Hydrographs of Water Levels in Observation Wells in Idaho, 1971-82,
W84-00831 7C

Water-Level Maps of the Alluvial Aquifer, Northwestern Mississippi September 1981,
W84-00921 7C

Hydrologic Data for the Pelican River Sands Aquifer, Western Minnesota,
W84-00947 7C

Ground-Water Data for Georgia, 1981,
W84-00986 7C

Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge,
W84-01048 7B

Measurement and Computation of Streamflow: Volume 2. Computation of Discharge,
W84-01049 2E

WATER MANAGEMENT
Proceedings: Illinois Water-Data Users Meeting, Peoria, Illinois, February 23-24, 1982.
W84-00818 7A

WATER MEASUREMENT
Proceedings: Illinois Water-Data Users Meeting, Peoria, Illinois, February 23-24, 1982.
W84-00818 7A

Water Quality Monitoring - Rivers and Streams, 1982.
W84-00910 7C

WATER POLICY
Harbor Management Strategies for New England,
W84-00907 6B

WATER POLLUTION
Specific Identification of Organic Pollutants in Haw River Water Using Gas Chromatography/Mass Spectrometry,
W84-00959 5A

WATER POLLUTION CONTROL
Subbasins 14 and 16, Genesee River and Upper Allegheny River,
W84-00838 6B

Water Quality Monitoring - Rivers and Streams, 1982.
W84-00910 7C

WATER POLLUTION EFFECTS
Hydrocarbon Fuels in Ground Water--Increased Awareness and Concern in New Mexico,
W84-00854 5B

A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River,
W84-00909 5C

Water Quality Monitoring - Rivers and Streams, 1982.
W84-00910 7C

Nonpoint Sources,
W84-00916 6B

WATER POLLUTION SOURCES

Effect of Urbanization on the Water Resources of Warminster Township, Bucks County, Pennsylvania,
W84-00774 5B

Status of Ground Water Quality in Logan Township, Gloucester County,
W84-00782 5B

The State Water Plan, Subbasin 19, Monongahela River.
W84-00785 6D

The State Water Plan, Subbasin 18, Lower Allegheny River.
W84-00786 5B

Subbasin 15, Lake Erie,
W84-00840 6B

Nonpoint Sources,
W84-00916 6B

General Hydrology and External Sources of Nutrients Affecting Pine Lake, King County, Washington,
W84-01015 2H

Chloroform Contamination in Part of the Alluvial Aquifer, Southwest Louisville, Kentucky,
W84-01030 5B

WATER QUALITY

A Hydrologic Analysis of the New Jersey Pine Barrens Region,
W84-00781 2A

Status of Ground Water Quality in Logan Township, Gloucester County,
W84-00782 5B

Iron in Ground Waters of the Magothy and Raritan Formations in Camden and Burlington Counties, New Jersey,
W84-00790 5B

Geology and Ground Water Resources of Hunterdon County, New Jersey,
W84-00791 2F

Limnological Characteristics of Wisconsin Lakes,
W84-00794 2H

Stream Surveillance and Analysis: Shabakunk Creek and Little Bear Brook Watersheds,
W84-00801 5B

Chemical Quality of Water in the Upper Part of the Floridian Aquifer, Duval County, Florida,
W84-00806 7C

Map Showing Groundwater Conditions in the Tonto Basin Area, Gila County, Arizona--1979,
W84-00807 7C

Water-Quality Assessment of the American River, California,
W84-00828 5B

Ground-Water Data from Selected Wells in Alluvial Aquifers, Powder River Basin, Northeastern Wyoming,
W84-00830 7C

State Water Plan: Subbasin 9, Central West Branch Susquehanna River.
W84-00844 6B

State Water Plan: Subbasin 8, Upper West Branch Susquehanna River.
W84-00845 5B

Long Range Plans for Hydrologic Investigations,
W84-00852 6B

Annual Water-Resources Review, white Sands Missile Range, New Mexico, 1981,
W84-00872 2F

Ground-Water Conditions in the Eastern Part of Michaud Flats, Fort Hall Indian Reservation, Idaho,
W84-00879 2F

Water-Quality Data for Smith and Bybee Lakes: Portland, Oregon, June to November, 1982,
W84-00890 7C

Hydrology of Coal-Resource Areas in the Southern Wasatch Plateau, Central Utah,
W84-00893 2A

Potential Effects of Surface Coal Mining on the Hydrology of the Cook Creek Area, Ashland Coal Field, Southeastern Montana,
W84-00899 4C

Water Quality of the Barataria Marsh Unit, Jean Lafitte National Historic Park, Louisiana (April 1981-March 1982),
W84-00900 7C

Water Quality of the Tidal River and Estuary; Hydrologic Data Report, 1981 Water Year with a Section on Chlorophyll-A: Collection and Analysis,
W84-00906 7C

Water-Quality Assessment of the Merced River, California,
W84-00924 5B

Data for Ground-Water Test Hole near Zamora, Central Valley Aquifer Project, California,
W84-00927 7C

Reconnaissance of Stormwater-Runoff Water Quality of the Big Piney Creek Segment of the Cedar-Piney Watershed, Yell County, Arkansas,
W84-00933 5B

Geohydrologic Reconnaissance of Lake Mead National Recreation Area--Las Vegas Wash to Opal Mountain, Nevada,
W84-00934 2F

Index of Hydrologic Data for Selected Sites in Broward County, Florida, 1939-80,
W84-00943 7C

Hydrologic Data for the Pelican River Sands Aquifer, Western Minnesota,
W84-00947 7C

Reconnaissance of Ground-Water Quality, Eastern Snake River Basin, Idaho,
W84-00974 2F

Hydrologic Effects of Storing Liquified Sewage Sludge on Strip-Mined Land in Fulton County, Illinois,
W84-00977 5E

Microcomputer Computation of Water Quality Discharges,
W84-00985 2J

Literature Assessment of the Charlotte Harbor Estuarine System and Surrounding Area, Southwest Florida,
W84-00992 10C

Evaluation of Water-Quality Characteristics of Part of the Spokane Aquifer, Washington and Idaho, Using a Solute-Transport Digital Model,
W84-01001 2F

Water Resources of the Santa Fe River Basin, Florida,
W84-01013 2F

Impact of Changes in Land Use on the Ground-Water System in The Sequim-Dungeness Peninsula, Clallam County, Washington,
W84-01014 4C

Hydrology, Water Quality, and Biology of Baptiste Collette Bayou in Relation to the Mississippi River at Venice, Louisiana,
W84-01025 5B

Water Resources of Manatee County Florida,
W84-01026 2F

Evaluation of Selected One-Dimensional Stream Water Quality Models with Field Data,
W84-01027 5B

Water Resources Data, North Carolina, Water Year 1982,
W84-01028 7C

Water-Quality Assessment of Francis E. Walter Reservoir, Luzerne and Carbon Counties, Pennsylvania,
W84-01029 2H

Quality of Water in Luxapallila Creek at Columbus, Mississippi,
W84-01034 5B

Quality of Water and Time of Travel in Bakers Creek Near Clinton, Mississippi,
W84-01035 5B

Hydrology of Area 49, Northern Great Plains and Rocky Mountain Coal Provinces, Montana and Wyoming,
W84-01043 2A

Water Resources Data for Puerto Rico, 1981-82,
W84-01044 7C

WATER QUALITY CONTROL

The State Water Plan, Subbasin 19, Monongahela River.
W84-00785 6D

Industrial Wastewater,
W84-00917 5G

What is the Condition of Our Surface Water.,
W84-00919 5G

WATER QUALITY CRITERIA

Point Source Waste Load Allocation for the Town of Red River,
W84-00855 5G

WATER QUALITY DATA

Compilation of Ground-Water Quality Data for Selected Wells in Elmore, Owyhee, Ada, and Canyon Counties, Idaho, 1945 through 1982,
W84-00834 7C

Water Quality of the Potomac River at Chain Bridge at Washington, D.C., Hydrologic Data Report, 1978 Water Year,
W84-00861 7C

Statistical Summaries of Selected Chemical Constituents in Kansas Ground-Water Supplies,
W84-00869 2F

Water-Quality Data for the American River Basin, California, February-October 1979,
W84-00938 7C

WATER QUALITY MANAGEMENT

Mercer County Stormwater Toxics Management Project: Delaware and Raritan Canal Conduit Special Study, Trenton, New Jersey.
W84-00802 5B

Problems and Issues Related to Managing Water Supply and Water Quality Between North Carolina and Virginia,
W84-00961 6E

WATER QUALITY STANDARDS

WATER QUALITY STANDARDS
Subbasin 13, Potomac River.
W84-00841 6D

The Puerco River: Muddy Issues Raised by a Mine Water Dominated Ephemeral Stream,
W84-00853 5B

Point Source Waste Load Allocation for the Town of Red River,
W84-00855 5G

Removing Uranium From Drinking Water Supplies: Demonstration of Selected Ion Exchange and Chemical Clarification,
W84-00857 5F

Industrial Wastewater,
W84-00917 5G

What is the Condition of Our Surface Water.,
W84-00919 5G

Water-Quality Assessment of the Merced River, California,
W84-00924 5B

WATER RESOURCES
Ground-Water Resources of Ransom and Sargent Counties, North Dakota,
W84-01050 2F

WATER RESOURCES DEVELOPMENT
The Economic Value of Ground Water Recharge for Irrigation Use,
W84-00957 4B

WATER REUSE
Chemistry and Application of Ozone and Ozone/UV Light for Water Reuse-II,
W84-00962 5D

WATER RIGHTS
Legal Aspects of Stored Water in Federal Reservoirs in Kansas,
W84-00971 6E

WATER SAMPLING
Water Quality Monitoring - Rivers and Streams, 1982.
W84-00910 7C

Hydraulic Considerations in Sampling the Unsaturated Zone with Inclined Gravity Lysimeters,
W84-01018 2G

WATER SUPPLY
Membrane Processes for Water Supply and Reuse - A Question of Energy Consumption and Cost,
W84-00713 3A

Activities in Spain,
W84-00757 3A

A Hydrologic Analysis of the New Jersey Pine Barrens Region,
W84-00781 2A

Morris County Master Plan: Water Supply Element.
W84-00788 6D

Geology and Ground Water Resources of Hunterdon County, New Jersey,
W84-00791 2F

Water Resources Resume: State Atlas Sheet No. 23, Parts of Bergen, Morris and Passaic Counties,
W84-00792 7C

Ground Water for Public Supply at Windigo, Isle Royale National Park, Michigan,
W84-00880 2F

The Economic Value of Ground Water Recharge for Irrigation Use,
W84-00957 4B

Problems and Issues Related to Managing Water Supply and Water Quality Between North Carolina and Virginia,
W84-00961 6E

WATER SUPPLY DEVELOPMENT
Morris County Master Plan: Water Supply Element.
W84-00788 6D

Wanaque South Project Economic Feasibility Study, Executive Summary.
W84-00789 6B

WATER TABLE
Ground-Water Levels in Selected Well Fields and in West-Central Florida, May 1982,
W84-00867 7C

WATER TREATMENT
A Tailored Process for Remineralization and Potabilization of Desalinated Water,
W84-00768 3A

WATER USE
The Benchmark Farm Program-- A Method for Estimating Irrigation Water Use in Southwest Florida,
W84-00808 7C

Water-Quality Assessment of the American River, California,
W84-00828 5B

Point Source Waste Load Allocation for the Town of Red River,
W84-00855 5G

Estimated Water Use in Southwest Florida, 1981, and Summary of Annual Water Use, 1970, 1975, and 1977-81,
W84-00892 7C

Estimated Water Use in Missouri, 1980,
W84-00894 7C

Consumptive Use of Freshwater in Florida, 1980,
W84-00898 7C

Water-Quality Assessment of the Merced River, California,
W84-00924 5B

Water Use in Wisconsin, 1979,
W84-00928 7C

Pumpage of Water in Louisiana, 1980,
W84-00997 6D

WATER-USE TRENDS
Pumpage of Water in Louisiana, 1980,
W84-00997 6D

WATER UTILIZATION
Pumpage of Water in Louisiana, 1980,
W84-00997 6D

WATER WELLS
Reconnaissance of Ground-Water Quality, Eastern Snake River Basin, Idaho,
W84-00974 2F

WATER YIELD
A Hydrologic Analysis of the New Jersey Pine Barrens Region,
W84-00781 2A

Geology of the Ground Water Resources of Mercer County,
W84-00799 2F

Report on Review of Water Supply Planning, Recommendations and Strategy for Western Connecticut.
W84-00911 6B

WATERFRONT FACILITIES
Prospects and Strategies for New England Ports.
W84-00908 6B

WATERSHEDS (BASIN)
Drainage Areas in New Jersey: Delaware River Basin and Streams Tributary to Delaware Bay,
W84-00904 7C

WELL DATA
Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area,
W84-00783 2F

Geology of the Ground Water Resources of Mercer County,
W84-00799 2F

Compilation of Ground-Water Quality Data for Selected Wells in Elmore, Owyhee, Ada, and Canyon Counties, Idaho, 1945 through 1982,
W84-00834 7C

Records of Selected Wells and Lithologic Logs of Test Holes, Hendry County and Adjacent Areas, Florida,
W84-00945 7C

WELL HYDROGRAPHS
Trends in Ground-Water Levels in Wisconsin Through 1981,
W84-01047 7C

WELL LOGS
Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area,
W84-00783 2F

WELL YIELD
Geology of the Ground Water Resources of Mercer County,
W84-00799 2F

Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

WELLS
Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area,
W84-00783 2F

Water Resources Resume: State Atlas Sheet No. 23, Parts of Bergen, Morris and Passaic Counties,
W84-00792 7C

WEST VIRGINIA
Drainage Areas of the Kanawha River Basin,
W84-00948 7C

Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

WET LANDS
Hydrogeology of a Landfill Operation, Pinellas County, Florida,
W84-00996 5B

WETLANDS
Wetland Hydrology and Tree Distribution of the Apalachicola River Flood Plain, Florida,
W84-00813 2I

Hydrology of Wisconsin, Wetlands,
W84-00998 2H

WHITE RIVER BASIN
Ground-Water Resources of the White River Basin, Hamilton and Tipton Counties, Indiana, W84-00930 2F

Ground-Water Resources of the White River Basin, Delaware County, Indiana, 1977, W84-00931 2F

WILD RIVERS
Subbasin 11, Upper Juniata River, W84-00839 6B

State Water Plan: Subbasin 9, Central West Branch Susquehanna River. W84-00844 6B

WILDERNESS AREAS
State Water Plan: Subbasin 9, Central West Branch Susquehanna River. W84-00844 6B

WILDLIFE HABITATS
A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River, W84-00909 5C

WIND
Desalination and Renewable Energies - A Few Recent Developments, W84-00755 3A

WIND TURBINES
Integrating Intermittent and Renewable Power Resources into the Hydropower system of the Pacific Northwest, W84-00958 6A

WISCONSIN
Limnological Characteristics of Wisconsin Lakes, W84-00794 2H

A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River, W84-00909 5C

Water Use in Wisconsin, 1979, W84-00928 7C

Trends in Ground-Water Levels in Wisconsin Through 1981, W84-01047 7C

WISCONSIN WETLANDS
Hydrology of Wisconsin, Wetlands, W84-00998 2H

WITHDRAWAL
Annual Summary of Ground-Water Conditions in Arizona, Spring 1981 to Spring 1982, W84-00824 7C

Annual Summary of Ground-Water Conditions in Arizona, Spring 1980 to Spring 1981. W84-00941 7C

Potential Hydrologic Impacts of Ground-Water Withdrawals from the Cape Cod National Seashore, Truro, Massachusetts, W84-00944 2F

Water Resources of Borrego Valley and Vicinity, California, Phase 1--Definition of Geologic and Hydrologic Characteristics of Basin, W84-00980 7C

WYOMING
Hydrogeologic Features of the Alluvial Deposits in the Owl Creek Valley, Bighorn Basin, Wyoming, W84-00770 2F

Ground-Water Data from Selected Wells in Alluvial Aquifers, Powder River Basin, Northeastern Wyoming, W84-00830 7C

A Plan for Hydrologic Investigations of In-Situ Oil Shale Retorting Near Rock Springs, Wyoming, W84-00873 2F

Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming, Part IV. Bed Elevations, 1980, W84-00936 7C

Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming: Part III. River Hydraulics and Sediment Transport, 1980, W84-00937 7C

Ground-Water Levels in Wyoming, 1971 Through Part of 1980, W84-00950 7C

Reservoir-Development Impacts on Surface-Water Quantity and Quality in the Yampa River Basin, Colorado and Wyoming, W84-01042 4C

Hydrology of Area 49, Northern Great Plains and Rocky Mountain Coal Provinces, Montana and Wyoming, W84-01043 2A

YAZOO NAVIGATION STUDY
Hydrologic Monitoring in the Area of the Proposed Yazoo River Navigation Project, West Central Mississippi, 1978-80, W84-00942 7C

ZEOLITES
Mineralogy of Fine-Grained Alluvium from Borehole U11g, Expl. 1, Northern Frenchman Flat Area, Nevada Test Site, W84-00946 2J

AUTHOR INDEX

ABDEL-KHALIK, S. I.
Design of a Commercial Solar-Powered Greenhouse,
W84-00723 3A

ABDUL-FATTAH, A-R. F.
Handling of Fuzzy Decisions in the Engineering Management of Large Desalination Plants,
W84-00766 3A

ADAMS, D. B.
Reservoir-Development Impacts on Surface-Water Quantity and Quality in the Yampa River Basin, Colorado and Wyoming,
W84-01042 4C

AEHMAD, G.
Geohydrology of the Fresh-Water Aquifer System in the Vicinity of Ocean City, Maryland,
W84-01011 2F

AL KASABI, T. O.
Design of a Commercial Solar-Powered Greenhouse,
W84-00723 3A

ALARRAYEDH, M.
Operational Experience of 2 x 11,500 m super 3 d Msf Seawater Desalination Plant,
W84-00741 3A

ALAWADI, A. M.
Operational Experience of 2 x 11,500 m super 3 d Msf Seawater Desalination Plant,
W84-00741 3A

ALBRIGHT, L. L.
Water-Resources Investigations in North Dakota--Fiscal Year 1983,
W84-00888 9C

ALDRIDGE, B. N.
Floods of November 1978 to March 1979 in Arizona and West-Central New Mexico,
W84-00837 7C

Floods of October 1977 in Southern Arizona and March 1978 in Central Arizona,
W84-00953 2E

ANDERSON, H. R.
Geology and Ground-Water Resources of the Rahway Area, New Jersey,
W84-00796 2F

ANDERSON, W.
Geohydrology of the Floridan Aquifer in the Withlacoochee River Basin of the Southwest Florida Water Management District,
W84-00984 7C

Hydrology of the Hamilton Lakes and Vicinity, Polk County, Central Florida,
W84-00905 7C

ANDRES, S.
Status of Ground Water Quality in Logan Township, Gloucester County,
W84-00782 5B

ARIHOOD, L. D.
Ground-Water Resources of the White River Basin, Delaware County, Indiana, 1977,
W84-00931 2F

Ground-Water Resources of the White River Basin, Hamilton and Tipton Counties, Indiana,
W84-00930 2F

ARMSTRONG, C. A.
Evaluation of the Hydrologic System in the New Leipzig Coal Area, Grant and Hettinger Counties, North Dakota,
W84-01022 2F

Ground-Water Resources of Ransom and Sargent Counties, North Dakota,
W84-01050 2F

AYERS, M. A.
Quality of Runoff From Small Watersheds in the Twin Cities Metropolitan Area, Minnesota--Hydrologic Data for 1980,
W84-00982 7C

BADER, J. S.
Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

BAKISH, R.
The Caribbean, the other Area of Concentration of Desalination Plants,
W84-00751 3A

Education and Training in Desalination Around the World,
W84-00764 3A

Proceedings of the International Congress on Desalination and Water Reuse, Manama, Bahrain, Nov. 29-Dec. 3, 1981,
W84-00716 3A

BALABAN, M.
Proceedings of the International Congress on Desalination and Water Reuse, Manama, Bahrain, Nov. 29-Dec. 3, 1981,
W84-00716 3A

BARKER, J. L.
Water-Quality Assessment of Francis E. Walter Reservoir, Luzerne and Carbon Counties, Pennsylvania,
W84-01029 2H

BARKER, R. A.
Analysis and Computer Simulation of Stream-Aquifer Hydrology, Arkansas River Valley, Southwestern Kansas,
W84-01016 2A

BARR, G. L.
Ground-Water Levels in Selected Well Fields and in West-Central Florida, May 1982,
W84-00867 7C

BATCHELDER, G. L.
Hydrogeochemical Cycling in a Watershed-Groundwater System: Fort River and Cadwell Creek, Massachusetts,
W84-00967 5B

BAUER, D. P.
Reservoir-Development Impacts on Surface-Water Quantity and Quality in the Yampa River Basin, Colorado and Wyoming,
W84-01042 4C

BENNETT, J. P.
Determination of Ultimate Carbonaceous BOD and the Specific Rate Constant (K sub 1),
W84-00805 5A

BENTLEY, C. B.
Principal Aquifers in Florida,
W84-01004 7C

BERTOLDI, G. L.
Data for Ground-Water Test Hole near Zamora, Central Valley Aquifer Project, California,
W84-00927 7C

BEVANS, H. E.
Water-Quality and Fluvial-Sediment Characteristics of Selected Streams in Northeast Kansas,
W84-01045 2J

BJERKE, B.
Membrane Technology and Costs; State of the Art,
W84-00710 3A

BLACK, D. W.
Experience in Commissioning Large Desalination Plants in the Middle East,
W84-00742 3A

BLACKWELL, C. D.
Directory of Assistance Centers of the National Water Data Exchange (NAWDEX),
W84-00814 10D

Directory of Member Organizations of the Naitonal Water Data Exchange (NAWDEX),
W84-00816 10D

BLAKE, T. R.
Virgin Islands Water and Power Authority (VIWAPA) Horizontal Tube, Falling Film, Low Temperature 1.25 MGD Multi-Effect Distillation Dual Purpose Plant,
W84-00750 3A

BLANCHARD, S. F.
Water Quality of the Potomac River at Chain Bridge at Washington, D.C., Hydrologic Data Report, 1978 Water Year,
W84-00861 7C

Water Quality of the Tidal River and Estuary; Hydrologic Data Report, 1981 Water Year with a Section on Chlorophyll-A: Collection and Analysis,
W84-00906 7C

BOESPFLUG, K. L.
Data from the Surface-Water Hydrologic Investigations of the Hay Creek Study Area, Montana, and the West Branch Antelope Creek Study Area, North Dakota, October 1976 through April 1982,
W84-00976 7C

BOJE, R. R.
Reconnaissance for Determining Effects of Land Use and Surficial Geology on Concentrations of Selected Elements on Streambed Materials from the Coal Mining, Region, Southwestern Indiana, October 1979 to March 1980,
W84-00771 5B

BOLKE, E. L.
Evaluation of Water-Quality Characteristics of Part of the Spokane Aquifer, Washington and Idaho, Using a Solute-Transport Digital Model,
W84-01001 2F

BORCSIK, M. P.
Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

BOURGEOIS, S.
Development of Environmental Standards for Combined Desalination/Power Generating Stations in the Arabian Gulf Region,
W84-00744 3A

BOWMAN, T. E.
Design of a Small Solar-Powered Desalination System,
W84-00725 3A

BRACKLEY, R. A.
Drainage Divides, Massachusetts--Ipswich and Lower Merrimack River Basins and Northeast Coastal Basins,
W84-00833 7C

Drainage Divides, Massachusetts--Nashua and Concord River Basins,
W84-00822 7C

BRAGG, R. L.
Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

BRANDON, C. A.
Closed Cycle Textile Dyeing:Full Scale Renovation of Hot Wash Water by Hyperfiltration,
W84-00749 3A

BRINING, D. L.
Development of Environmental Standards for Combined Desalination/Power Generating Stations in the Arabian Gulf Region,
W84-00744 3A

BROOKS, R.
Hydrogeology of the Providence Aquifer of Southwest Georgia,
W84-01031 2F

BROWN, D. P.
Water Resources of Manatee County Florida,
W84-01026 2F

BROWN, R. G.
Quality of Runoff From Small Watersheds in the Twin Cities Metropolitan Area, Minnesota--Hydrologic Data for 1980,
W84-00982 7C

BRUNNER, G.
An Integrated Self Sufficient Multipurpose Plant for Seawater Desalination,
W84-00763 3A

BUCHMILLER, R. C.
Semiannual Water-Level and Potentiometric Contours of Two Water-Yielding Zones in the Surficial Aquifer, 1975-79, Naples, Florida,
W84-00803 7C

BUGLIOSI, E. F.
Major Aquifers in Yankton County, South Dakota,
W84-00979 2F

BUROS, O. K.
An Introduction to New Energy Sources for Desalination,
W84-00721 3A

BUSH, P. W.
Predevelopment Flow in the Tertiary Limestone Aquifer, Southeastern United States: A Regional Analysis From Digital Modeling,
W84-00884 2F

CANNON, M. R.
Potential Effects of Surface Coal Mining on the Hydrology of the Cook Creek Area, Ashland Coal Field, Southeastern Montana,
W84-00899 4C

CANTERA, F.
Activities in Spain,
W84-00757 3A

CARMAN, R. L.
Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan,
W84-01008 2F

CARTER, R. F.
Monthly Low-Flow Characteristics of Georgia Streams,
W84-00923 7C

CASE, H. L.
Long Range Plans for Hydrologic Investigations,
W84-00852 6B

CASINI, G. F.
Reducing and Monitoring Corrosion in MSF Evaporators in the Change-Over From Acid Treatment to Treatment with Additives,
W84-00753 3A

CAUSARAS, C. R.
Index of Hydrologic Data for Selected Sites in Broward County, Florida, 1939-80,
W84-00943 7C

Records of Selected Wells and Lithologic Logs of Test Holes, Hendry County and Adjacent Areas, Florida,
W84-00945 7C

CHAMBERLIN, C. E.
Noupoint Sources,
W84-00916 6B

CHEN, H. H.
Geohydrology of the High Plains Aquifer System in Nebraska,
W84-01002 7C

CHISHOLM, J. L.
Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

CHRISTMAN, R. F.
Specific Identification of Organic Pollutants in Haw River Water Using Gas Chromatography/Mass Spectrometry,
W84-00959 5A

CLARKE, J. S.
Hydrogeology of the Providence Aquifer of Southwest Georgia,
W84-01031 2F

CLIFTON, D. G.
Water-Quality Data for Smith and Bybee Lakes: Portland, Oregon, June to November, 1982,
W84-00890 7C

CLINE, D. R.
Preliminary Survey of Ground-Water Resources for Island County, Washington,
W84-00878 2F

COCHRAN, B. J.
Rainfall-Runoff Data From Small Watersheds in Colorado, October 1977 Through September 1980,
W84-00858 7C

COLE, J. R.
Historic and Prehistoric Patterns of Water Use in the Connecticut River Valley: Implications for Water Resources Planning,
W84-00968 6D

COLON-RAMOS, H. M.
Water Resources Data for Puerto Rico, 1981-82,
W84-01044 7C

COMER, D. A.
The Economic Value of Ground Water Recharge for Irrigation Use,
W84-00957 4B

CONDES DE LA TORRE, A.
Funding History of the U.S. Geological Survey Federal Data Collection and Analysis Program,
W84-00836 9D

COOLEY, M. E.
Hydrogeologic Features of the Alluvial Deposits in the Owl Creek Valley, Bighorn Basin, Wyoming,
W84-00770 2F

COTTER, R. D.
Trends in Ground-Water Levels in Wisconsin Through 1981,
W84-01047 7C

COUPE, R. H. JR.
Water Quality of the Tidal River and Estuary; Hydrologic Data Report, 1981 Water Year with a Section on Chlorophyll-A: Collection and Analysis,
W84-00906 7C

CRAIG, J. D.
Installation and Service Manual for U.S. Geological Survey Manometers,
W84-00811 7B

CRERAR, D. A.
Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

CRUZ, R. R.
Annual Water-Resources Review, white Sands Missile Range, New Mexico, 1981,
W84-00872 2F

CURTIS, R. E.
Water Resources Data for Puerto Rico, 1981-82,
W84-01044 7C

CURTISS, D. A.
An Evaluation of Suspended Sediment and Turbidity in Cow Creek, Oregon,
W84-00939 2J

CUSHMAN-ROISIN, J.
Principal Aquifers in Florida,
W84-01004 7C

DALE, R. H.
Reservoir-Development Impacts on Surface-Water Quantity and Quality in the Yampa River Basin, Colorado and Wyoming,
W84-01042 4C

DANIELSON, T. W.
Hydrology of Coal-Resource Areas in the Southern Wasatch Plateau, Central Utah,
W84-00893 2A

DARBY, D. W.
Selected Hydrologic Data, 1978-80, Price River Basin, Utah,
W84-00825 7C

DARDEN, D.
Hydrologic Monitoring in the Area of the Proposed Yazoo River Navigation Project, West Central Mississippi, 1978-80,
W84-00942 7C

Water-Level Maps of the Alluvial Aquifer, Northwestern Mississippi September 1981,
W84-00921 7C

DAVIS, D. K.
Effect of Urbanization on the Water Resources of Warminster Township, Bucks County, Pennsylvania,
W84-00774 5B

DAVIS, R. W.
Chloroform Contamination in Part of the Alluvial Aquifer, Southwest Louisville, Kentucky,
W84-01030 5B

DE MAIO, A.
A New Idea for Training Operators,
W84-00765 3A

DECKER, E. M.
Water-Resources Investigations of the U.S. Geological Survey in South Dakota,
W84-00827 7A

DEJMEK, P.
System Options and Costs in Dairy Ultrafiltration,
W84-00712 3A

DEMAS, C. R.
Hydrology, Water Quality, and Biology of Baptiste Collette Bayou in Relation to the Mississippi River at Venice, Louisiana,
W84-01025 5B

DEMCHECK, D. K.
Water Quality of the Upper Vermilion River, Louisiana, April-August 1980,
W84-01046 5B

DENIS, E. E.
Map Showing Groundwater Conditions in the Tonto Basin Area, Gila County, Arizona--1979,
W84-00807 7C

DENOYELLES, F. JR.
Site Studies of Determine the Extent and Potential Impact of Herbicide Contamination in Kansas Waters,
W84-00970 5B

DERONZIER, J. C.
Solar Desalination: Prototype 'Pithon' A Special Solar Multiple-Effect Distiller,
W84-00729 3A

DI SIMONE, I. S.
Reducing and Monitoring Corrosion in MSF Evaporators in the Change-Over From Acid Treatment to Treatment with Additives,
W84-00753 3A

DIETRICH, A. M.
Specific Identification of Organic Pollutants in Haw River Water Using Gas Chromatography/ Mass Spectrometry,
W84-00959 5A

DILLARD, T. E.
Water Resources Data, North Carolina, Water Year 1982,
W84-01028 7C

DION, N. P.
General Hydrology and External Sources of Nutrients Affecting Pine Lake, King County, Washington,
W84-01015 2H

Preliminary Survey of Ground-Water Resources for Island County, Washington,
W84-00878 2F

DIX, T. E.
Design of a Commercial Solar-Powered Greenhouse,
W84-00723 3A

Development of Solar Desal, A Code for Modeling, Simulation and Design of Solar Desalination Systems,
W84-00734 3A

DODGE, J. E.
Selected Hydrologic Data, 1978-80, Price River Basin, Utah,
W84-00825 7C

DOERFER, J. T.
Hydrologic Data for Urban Storm Runoff in the Denver Metropolitan Area, Colorado,
W84-00859 7C

DOONAN, C. J.
Ground Water and Geology of Marquette County, Michigan,
W84-00925 2F

DOUGLAS, G.
Data from the Surface-Water Hydrologic Investigations of the Hay Creek Study Area, Montana, and the West Branch Antelope Creek Study Area, North Dakota, October 1976 through April 1982,
W84-00976 7C

DOWNS, S. C.
Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

DRELLACK, S. L. JR.
Geologic and Well-Construction Data for the H-10 Borehole Complex Near the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico,
W84-00901 5E

DROST, B. W.
Impact of Changes in Land Use on the Ground-Water System in The Sequim-Dungeness Peninsula, Clallam County, Washington,
W84-01014 4C

DUCRUET, P.
Utilization of the New Mineral UF Membranes for Making Semi-hard Cheeses,
W84-00701 3A

DUERR, A. D.
The Benchmark Farm Program-- A Method for Estimating Irrigation Water Use in Southwest Florida,
W84-00808 7C

Estimated Water Use in Southwest Florida, 1981, and Summary of Annual Water Use, 1970, 1975, and 1977-81,
W84-00892 7C

DUNCAN, R. E.
A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River,
W84-00909 5C

DUNLAP, L. E.
Analysis and Computer Simulation of Stream-Aquifer Hydrology, Arkansas River Valley, Southwestern Kansas,
W84-01016 2A

EBLING, J. L.
Annual Snowmelt and Rainfall Peak-Flow Data on Selected Foothills Region Streams, South Platte River Arkansas River, and Colorado River Basins, Colorado,
W84-01038 7C

EDDS, J.
Ground-Water Levels in Arkansas, Spring 1982,
W84-00870 7C

EDGMON, T. D.
Problems and Issues Related to Managing Water Supply and Water Quality Between North Carolina and Virginia,
W84-00961 6E

EDWARDS, M. D.
Definitions of Components of the Water Data Sources Directory Maintained by the National Water Data Exchange,
W84-00815 10D

Indentification Codes for Organizations Listed in Computerized Data Systems of the U.S. Geological Survey,
W84-00817 10D

EICEMAN, G. A.
Analysis of Water Samples for Toxic Volatile Organic Compounds: State of the Art Methods and Strategies for Sampling,
W84-00851 5A

EL-FOULY, M. F.
Heat Transfer and Fluid Flow Characteristics in Flash Desalination Units,
W84-00746 3A

EL HARES, H.
Instrumentation Problems in Libyn Desalination Plants,
W84-00719 3A

EL-MOGY, H. Z.
Heat Transfer and Fluid Flow Characteristics in Flash Desalination Units,
W84-00746 3A

EL-NASHAR, A. M.
Design of a Small Solar-Powered Desalination System,
W84-00725 3A

EL SALEM, M.
Experiments with Desalination of Arabian Gulf Water,
W84-00745 3A

EL SHEIKH SHOHEIB, R.
Ground Water Resources in Fayoum Area, Egypt,
W84-00747 3A

Origin of Subsurface Water in Khartoum Province, Sudan,
W84-00748 3A

ELLEFSON, R. R.
Water Use in Wisconsin, 1979,
W84-00928 7C

ELLIOTT, J. G.
Annual Snowmelt and Rainfall Peak-Flow Data on Selected Foothills Region Streams, South Platte River Arkansas River, and Colorado River Basins, Colorado,
W84-01038 7C

EMMETT, W. W.
Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming: Part III. River Hydraulics and Sediment Transport, 1980,
W84-00937 7C

Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming, Part IV. Bed Elevations, 1980,
W84-00936 7C

ENGWALL, H.
System Options and Costs in Dairy Ultrafiltration,
W84-00712 3A

ERDMANN, D. E.
Quality Assurance Practices for the Chemical and Physical Analyses of Water and Fluvial Sediments,
W84-00812 5A

ERICKSON, R. M.
Trends in Ground-Water Levels in Wisconsin Through 1981,
W84-01047 7C

ERICSSON, B.
Membrane Processes for Water Supply and Reuse - A Question of Energy Consumption and Cost,
W84-00713 3A

ERIKSSON, P.
Preconcentration by Reverse Osmosis Before Evaporation - Possibilities in Sweden,
W84-00714 3A

EYCHANER, J. H.
Floods of October 1977 in Southern Arizona and March 1978 in Central Arizona,
W84-00953 2E

FAYARD, L. D.
Geohydrologic Reconnaissance of Drainage Wells in Florida--An Interim Report,
W84-00865 4B

FAYE, E.
Hydrogeology of the Providence Aquifer of Southwest Georgia,
W84-01031 2F

FEIZLMAYR, A. H.
The Riyadh Water Transmission System (RWTS),
W84-00743 3A

FENTON, G. G.
Comparison of Solar RO and Solar Thermal Desalination Systems,
W84-00727 3A

Desalination in Australia - Past and Future,
W84-00758 3A

Solar Distillation: The Solar-Driven Case,
W84-00726 3A

FINCH, A. J.
Atlas of Eleven Selected Aquifers in New York,
W84-00983 7C

FIORAVANTI, F.
A New Idea for Training Operators,
W84-00765 3A

FISH, J. E.
Index of Hydrologic Data for Selected Sites in Broward County, Florida, 1939-80,
W84-00943 7C

Records of Selected Wells and Lithologic Logs of Test Holes, Hendry County and Adjacent Areas, Florida,
W84-00945 7C

FISH, R. E.
Report of the River Master of the Delaware River for the Period December 1, 1980-November 30, 1981,
W84-01040 3D

FITZPATRICK, D. J.
Hydrologic Data From Monitoring of Saline-Water Intrusion in the Cape Coral Area, Lee County, Florida,
W84-00935 7C

FLIPPO, H. N. JR.
Evaluation of the Stream-flow Data in Pennsylvania,
W84-00809 7A

FOOSE, D. W.
Selected Flow Characteristics of Florida Streams and Canals,
W84-01012 7C

FRANKLIN, M. A.
Wetland Hydrology and Tree Distribution of the Apalachicola River Flood Plain, Florida,
W84-00813 2I

FRANKS, J.
Principal Aquifers in Florida,
W84-01004 7C

FREDETTE, C. G.
Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport,
W84-00999 5B

FREETHEY, G. W.
Hydrologic Analysis of the Upper San Pedro Basin from the Mexico-United States International Boundary to Fairbank, Arizona,
W84-01023 2A

FRENCH, J. J.
Data for Ground-Water Test Hole near Zamora, Central Valley Aquifer Project, California,
W84-00927 7C

FRIDAY, J.
Flood Profiles in the Calapooya Creek Basin, Oregon,
W84-01021 7C

FRIEDMAN, L. C.
Quality Assurance Practices for the Chemical and Physical Analyses of Water and Fluvial Sediments,
W84-00812 5A

FRIES, S.
Wind and Solar Powered Reverse Osmosis Desalination Units-Design, Start Up, Operating Experience-,
W84-00730 3A

FRIMPTER, M. H.
Drainage Divides, Massachusetts--Taunton River Basin and Southeast Coastal Basins,
W84-00868 7C

FRINK, C. R.
Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport,
W84-00999 5B

FRINK, D. L.
Changes in Flood Response of the Red River of the North Basin, North Dakota-Minnesota,
W84-01020 4C

FROELICH, D. C.
A Two-Dimensional Finite-Element Model Study of Backwater and Flow Distribution at the I-10 Crossing of the Pearl River Near Slidell, Louisiana,
W84-00896 2A

FULFORD, J. M.
Floods of December 1982 and January 1983 in Central and Southern Mississippi River Basin,
W84-00886 7C

GABBRIELLI, E.
A Tailored Process for Remineralization and Potabilization of Desalinated Water,
W84-00768 3A

GADDIS, J. L.
Closed Cycle Textile Dyeing:Full Scale Renovation of Hot Wash Water by Hyperfiltration,
W84-00749 3A

GALLAHER, B.
The Puerco River: Muddy Issues Raised by a Mine Water Dominated Ephemeral Stream,
W84-00853 5B

GAMBLE, C. R.
Cane Creek Flood-Flow Characteristics at State Route 30 Near Spencer, Tennessee,
W84-00871 4C

GARRISON, C. R.
Water Quality of the Barataria Marsh Unit, Jean Lafitte National Historic Park, Louisiana (April 1981-March 1982),
W84-00900 7C

GARTON, J. E.
Localized Destratification at Lake Texoma,
W84-00956 5G

GAYDOS, M. W.
Results of Pesticide Sampling in Tennessee,
W84-00889 7C

GEIGER, L. H.
Revised Description of Index of Florida Water Data Collection Active Stations and a User's Guide for Station or Site Information Retrieval Computer Program Findex H578,
W84-00885 10D

GEORGE, A. R.
Control and Instrumentation Experience at Lok on Pai Msf Seawater Desalination Plant,
W84-00720 3A

GEROFI, J. P.
Comparison of Solar RO and Solar Thermal Desalination Systems,
W84-00727 3A

Desalination in Australia - Past and Future,
W84-00758 3A

Solar Distillation: The Solar-Driven Case,
W84-00726 3A

GIANNUZZI, L. F.
Optimization of Integrated Cogeneration Power Plant and Desalination Plant Systems for a Range of Power and Water Supply Requirements,
W84-00761 3A

GIBB, J. W.
Hydrologic Data for Urban Storm Runoff in the Denver Metropolitan Area, Colorado,
W84-00859 7C

GILBERT, J. J.
A Two-Dimensional Finite-Element Model Study of Backwater and Flow Distribution at the I-10 Crossing of the Pearl River Near Slidell, Louisiana,
W84-00896 2A

GILLIAM, J. W.
Nitrate Loss from Agricultural Drainage Waters: Implications for Nonpoint Source Control,
W84-00965 5B

GILLIES, D. C.
Preliminary Evaluation of the Ground-Water-Flow System in the Twin Cities Metropolitan Area, Minnesota,
W84-00995 2F

GILLIOM, J. J.
Lake Phosphorus Loading From Septic Systems by Seasonally Perched Ground Water, Puget Sound Region, Washington,
W84-00883 5B

GLENN, F. M.
Map of the Antelope Valley-East Kern Water Agency Area, California, Showing Ground-Water Subunits and Areas, and Well Hydrographs, 1962 to 1982,
W84-00820 7C

GLIMENIUS, R.
Membrane Processes for Water, Pulp and Paper, Food. State of the Art,
W84-00702 3A

GLOVER, K. C.
A Plan for Hydrologic Investigations of In-Situ Oil Shale Retorting Near Rock Springs, Wyoming,
W84-00873 2F

GOLDBERG, M.
Ultrafiltration of Effluents from Slaughterhouses and Brine in the Meat Industry,
W84-00705 3A

GOUDEDRANCHE, H.
Utilization of the New Mineral UF Membranes for Making Semi-hard Cheeses,
W84-00701 3A

GRANNEMANN, N. G.
Ground Water for Public Supply at Windigo, Isle Royale National Park, Michigan,
W84-00880 2F

GUARINO, C. F.
Municipal Wastewater Treatment: 1970 and Today,
W84-00918 5G

GUNARD, K. T.
Small-Stream Flood Investigations in Minnesota, October 1958 to September 1980,
W84-01033 7C

GUNTER, H. C.
Water Resources Data, North Carolina, Water Year 1982,
W84-01028 7C

GUSWA, J. H.
Preliminary Evaluation of the Ground-Water-Flow System in the Twin Cities Metropolitan Area, Minnesota,
W84-00995 2F

GUZMAN, J.
Activities in Spain,
W84-00757 3A

HAENI, F. P.
Continuous Seismic-Reflection Survey Defining Shallow Sedimentary Layers in the Charlotte Harbor and Venice Areas, Southwest, Florida,
W84-00929 2F

HAGENSON, R.
Design of a Commercial Solar-Powered Greenhouse,
W84-00723 3A

HAGERDAL, B.
Membrane Technology Applied to Bioconversion of Macromolecular Substrates and Upgrading of Products. A Model Study on Ethanol Production from Cellulose,
W84-00709 3A

HALES, T. A.
Floods of November 1978 to March 1979 in Arizona and West-Central New Mexico,
W84-00837 7C

HAMESTER, H. L.
Engineering Design of a 6000 cu m/Day Seawater Hybrid RO-ED Helio-Desalting,
W84-00735 3A

HANDY, A. H.
Water Quality of Coal Deposits and Abandoned Mines, Saginaw County, Michigan,
W84-00926 7C

HANNULA, T. A.
Computer Simulation of Phosphorus Cycling in the Sediment-Water System of Eutrophic Lakes, W84-00964 2H

HANSEN, A. J. JR.
An Engineering Economic Analysis of Artificial Recharge in a Conjunctive Irrigation Plan in the Columbia Basin Project, Washington, W84-00989 4B

HANSEN, D. S.
Major Aquifers in Hanson and Davison Counties, South Dakota, W84-00978 2F

HAPKE, J.
Combined MSF/VTE-Modules for Hybrid Thermal Seawater Desalination Plants, W84-00756 3A

HARDT, W. F.
Water Resources and Geology of Gloucester County, New Jersey, W84-00798 2F

HARENBERG, W. A.
An Evaluation of Idaho Stream-Gaging Networks, W84-00866 7A

HARMON, J. G.
Graphical Method for Estimating Occurrence and Duration of a Critical Low Flow in the Sacramento River at Freeport, California, W84-00973 5G

Sediment and Stream-Velocity Data for the Sacramento River Near Hood, California, May 1978 to September 1981, W84-01003 7C

HARRILL, J. R.
Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan, W84-01008 2F

HARVEY, E. J.
Water Information for Northwestern Missouri--A Planning Document, W84-00810 3B

HAVENS, J. S.
Saturated Thickness of the High Plains Regional Aquifer in 1980, Northwestern Oklahoma, W84-00804 7C

HAYES, E. C.
Potentiometric Surface of the Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida, May 1982, W84-00819 7C

HEAD, W. J.
Hydrogeologic Features of the Alluvial Deposits in the Owl Creek Valley, Bighorn Basin, Wyoming, W84-00770 2F

HEALY, H. G.
Potentiometric Surface of the Floridan Aquifer in Florida, May 1980, W84-01005 7C

HEATH, M. S. JR.
Interstate Water Law Issues: Unilateral State Legislation, Original Suits in the Supreme Court, Interstate Compacts, W84-00960 6E

HELGESEN, J. O.
Model Modifications for Simulation of Flow Through Stratified Rocks in Eastern Ohio, W84-00773 4C

HELSEL, D. R.
Microcomputer Computation of Water Quality Discharges, W84-00985 2J

HENRY, D. L.
Advance in Water Quality Monitoring and the Use of Firefly Luciferine/Luciferase Atp Bioassay, W84-00769 5D

HESTER, W. G.
Ground-Water Data for Georgia, 1981, W84-00986 7C

HILAL, M. M.
Heat Transfer and Fluid Flow Characteristics in Flash Desalination Units, W84-00746 3A

HILL, C. L.
Water Resources Data, North Carolina, Water Year 1982, W84-01028 7C

HILTON, G. S.
Geology and Ground-Water Resources of Salem County, New Jersey, W84-00795 2F

Water Resources and Geology of Gloucester County, New Jersey, W84-00798 2F

HIRAI, M.
Operating Experience on Ro Sea Water Desalination Plant at Chigasaki Laboratory, W84-00759 3A

HORN, O. E.
Optimization of Integrated Cogeneration Power Plant and Desalination Plant Systems for a Range of Power and Water Supply Requirements, W84-00761 3A

HOWELLS, D. H.
Groundwater Management in the Southeast, W84-00955 4B

HSIAO, J. S.
Health and Safety Aspects of Irrigation of Raw-Eaten Food Crops with Reused Water, W84-00767 5D

HUFFMAN, G. C.
Ground-Water Data for Michigan, 1981, W84-00875 7C

HULL, R. W.
Data on Subsurface Storage of Liquid Waste Near Pensacola, Florida, 1963-1980, W84-00951 7C

HUNN, J. D.
Water Resources of the Santa Fe River Basin, Florida, W84-01013 2F

HUNRICHS, R. A.
Identification and Classification of Perennial Streams of Arkansas, W84-01041 7C

HUNTER, J. V.
Stream Surveillance and Analysis: Shabakunk Creek and Little Bear Brook Watersheds, W84-00801 5B

HUSSEINY, A. A.
An Assessment of the Market Potential for Small Solar Powered Desalination Plants, W84-00722 3A

Design of a Commercial Solar-Powered Greenhouse, W84-00723 3A

Design of a Small Solar-Powered Desalination System, W84-00725 3A

Engineering Design of a 6000 cu m/Day Seawater Hybrid RO-ED Helio-Desalting, W84-00735 3A

Performance Evaluation of MSF Plants, the Case of Jeddah Plants, W84-00739 3A

Reliability of the Jeddah Seawater RO Desalination Plant Based Upon Operations Experience, W84-00738 3A

HUTCHINSON, C. B.
Assessment of the Interconnection Between Tampa Bay and the Floridan Aquifer, Florida, W84-01019 2F

INOUE, G.
Advanced Treatment of Secondary Sewage Effluent by Membrane Process, W84-00760 5D

IRELAND, R. L.
Land Subsidence in the San Joaquin Valley, California, as of 1980, W84-00932 4B

JACOBS, T. C.
Nitrate Loss from Agricultural Drainage Waters: Implications for Nonpoint Source Control, W84-00965 5B

JACOBSON, N. D.
Ground-Water Conditions in the Eastern Part of Michaud Flats, Fort Hall Indian Reservation, Idaho, W84-00879 2F

JAKSIC, M. M.
Application of Selective Membranes in Grape Juice Stabilization, W84-00706 3A

JAMJOOM, I. M. P.
The Riyadh Water Transmission System (RWTS), W84-00743 3A

JARRETT, D.
Rainfall-Runoff Data From Small Watersheds in Colorado, October 1977 Through September 1980, W84-00858 7C

JARRETT, R. D.
Annual Snowmelt and Rainfall Peak-Flow Data on Selected Foothills Region Streams, South Platte River Arkansas River, and Colorado River Basins, Colorado, W84-01038 7C

JERCINOVIC, D.
Hydrocarbon Fuels in Ground Water--Increased Awareness and Concern in New Mexico, W84-00854 5B

JERNIGAN, D. A.
Closed Cycle Textile Dyeing:Full Scale Renovation of Hot Wash Water by Hyperfiltration, W84-00749 3A

JESSEE, W. N.
Development of Environmental Standards for Combined Desalination/Power Generating Stations in the Arabian Gulf Region, W84-00744 3A

JONES, B. F.
Mineralogy of Fine-Grained Alluvium from Borehole U11g, Expl. 1, Northern Frenchman Flat Area, Nevada Test Site, W84-00946 2J

JONES, J.
Health and Safety Aspects of Irrigation of Raw-Eaten Food Crops with Reused Water, W84-00767 5D

JONES, M. A.
Preliminary Survey of Ground-Water Resources for Island County, Washington, W84-00878 2F

JOSEFSON, B. M.
Directory of Assistance Centers of the National Water Data Exchange (NAWDEX),
W84-00814 10D

Indentification Codes for Organizations Listed in Computerized Data Systems of the U.S. Geological Survey,
W84-00817 10D

JUNDI, Z. M.
Test Results from a Solar Boiler for Saline Water Distillation,
W84-00724 3A

KACHROO, H.
Status of Ground Water Quality in Logan Township, Gloucester County,
W84-00782 5B

KADAJ, R.
Waste Heat Powered Reverse Osmosis Plants,
W84-00731 3A

KALKHOFF, S. J.
Quality of Water and Time of Travel in Bakers Creek Near Clinton, Mississippi,
W84-01035 5B

Quality of Water in Luxapallila Creek at Columbus, Mississippi,
W84-01034 5B

KANEDA, H.
Operating Experience on Ro Sea Water Desalination Plant at Chigasaki Laboratory,
W84-00759 3A

KARAVITIS, G. A.
Literature Assessment of the Charlotte Harbor Estuarine System and Surrounding Area, Southwest Florida,
W84-00992 10C

KARLINGER, M. R.
An Engineering Economic Analysis of Artificial Recharge in a Conjunctive Irrigation Plan in the Columbia Basin Project, Washington,
W84-00989 4B

Semi-Variogram Estimation and Universal Kriging Program (Computer Program Documentation, User'z Manual),
W84-00829 7C

KASABACH, H.
Water Resources Resume: State Atlas Sheet No. 23, Parts of Bergen, Morris and Passaic Counties,
W84-00792 7C

KASABACH, H. F.
Geology and Ground Water Resources of Hunterdon County, New Jersey,
W84-00791 2F

KELLEY, E. V.
Distributed Control Systems for Desalination,
W84-00717 3A

KETTLE, W. D.
Site Studies of Determine the Extent and Potential Impact of Herbicide Contamination in Kansas Waters,
W84-00970 5B

KHALAF, S.
Operational Experience of 2 x 11,500 m super 3 d Msf Seawater Desalination Plant,
W84-00741 3A

KHALIL, E. E.
Heat Transfer and Fluid Flow Characteristics in Flash Desalination Units,
W84-00746 3A

KIMREY, J. O.
Geohydrologic Reconnaissance of Drainage Wells in Florida--An Interim Report,
W84-00865 4B

KINSMAN, D. J. J.
Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

KIRKPATRICK, W. R.
Health and Safety Aspects of Irrigation of Raw-Eaten Food Crops with Reused Water,
W84-00767 5D

KLEIN, H.
Principal Aquifers in Florida,
W84-01004 7C

KNIGHTON, R.
Development of a Marine Osmotic Solar Still for a Sea Water Desalination,
W84-00736 3A

KNOTT, R. K.
Discharge Data at Water-Quality Monitoring Stations in Arkansas, 1980 Water Year,
W84-00887 7C

KRATZER, W. M.
Water-Resources Investigations of the U. S. Geological Survey in Missouri, Fiscal Year 1983,
W84-00862 7C

KRAUSE, R. E.
Digital Model Evaluation of the Predevelopment Flow System of the Tertiary Limestone Aquifer, Southeast Georgia, Northeast Florida, and Southern South Carolina,
W84-00779 2F

KREJMAS, B. E.
Drainage Divides, Massachusetts--Connecticut River Lowlands and Chicopee River Basin,
W84-00902 7C

KRIESI, R.
Design and Operation Experience with Solar Powered Multistage Desalination Plants,
W84-00728 3A

KUENSTLE, K.
An Integrated Self Sufficient Multipurpose Plant for Seawater Desalination,
W84-00763 3A

KUIPER, D.
Conceptual Design Aspects of Reverse Osmosis,
W84-00703 3A

KULP, K. P.
Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport,
W84-00999 5B

KUME, J.
Geohydrologic Data from Sandstone Aquifers in Southwestern Kansas,
W84-00864 7C

KUNISADA, Y.
Operating Experience on Ro Sea Water Desalination Plant at Chigasaki Laboratory,
W84-00759 3A

KUTBI, I. I.
Performance Evaluation of MSF Plants, the Case of Jeddah Plants,
W84-00739 3A

Reliability of the Jeddah Seawater RO Desalination Plant Based Upon Operations Experience,
W84-00738 3A

KVAJIC, G.
Solar Power/Desalination, PV ED System,
W84-00737 3A

LAESSER, P.
The Riyadh Water Transmission System (RWTS),
W84-00743 3A

LAMB, T. E.
Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1982 Water Year,
W84-00891 7C

Time of Travel of Selected Arkansas Streams,
W84-00895 2E

LANE, D. D.
Transport Modeling of an Agricultural Herbicide, A Laboratory Simulation,
W84-00969 5B

LANEY, R. L.
Geohydrologic Reconnaissance of Lake Mead National Recreation Area--Las Vegas Wash to Opal Mountain, Nevada,
W84-00934 2F

LANG, S. M.
Geology and Ground-Water Resources of Salem County, New Jersey,
W84-00795 2F

LANGMUIR, D.
Iron in Ground Waters of the Magothy and Raritan Formations in Camden and Burlington Counties, New Jersey,
W84-00790 5B

LANKFORD, N. K.
Water-Resources Investigations in North Dakota--Fiscal Year 1983,
W84-00888 9C

LAPHAM, W. W.
Ground-Water Resources of the White River Basin, Delaware County, Indiana, 1977,
W84-00931 2F

LAPRAY, J. F.
Studies, Testing and Development of a Line of Brine Recirculating Pumps for Sea Water Desalination Installations,
W84-00754 3A

LARSON, L. R.
A Plan for Hydrologic Investigations of In-Situ Oil Shale Retorting Near Rock Springs, Wyoming,
W84-00873 2F

LARSON, S. P.
Model Modifications for Simulation of Flow Through Stratified Rocks in Eastern Ohio,
W84-00773 4C

LASKOWSKI, S. L.
Statistical Summaries of New Jersey Streamflow Records,
W84-00800 7C

LAUGHLIN, C. P.
Geohydrology of the Floridan Aquifer in the Withlacoochee River Basin of the Southwest Florida Water Management District,
W84-00984 7C

LAURO, F.
Ocean Thermal Energy and Desalination,
W84-00733 3A

Solar Desalination: Prototype 'Pithon' A Special Solar Multiple-Effect Distiller,
W84-00729 3A

LAWRENCE, C. L.
Water Use in Wisconsin, 1979,
W84-00928 7C

LE GRAND, A.
Studies, Testing and Development of a Line of Brine Recirculating Pumps for Sea Water Desalination Installations,
W84-00754 3A

LEACH, S. D.
Consumptive Use of Freshwater in Florida, 1980,
W84-00898 7C

LEAHY, P. P.
A Three-Dimensional Ground-Water-Flow Model Modified to Reduce Computer-Memory Requirements and Better Simulate Confining-Bed and Aquifer Pinchouts,
W84-00775 2F

LEBLANC, D. R.
Potential Hydrologic Impacts of Ground-Water Withdrawals from the Cape Cod National Seashore, Truro, Massachusetts,
W84-00944 2F

LEE, J. K.
A Two-Dimensional Finite-Element Model Study of Backwater and Flow Distribution at the I-10 Crossing of the Pearl River Near Slidell, Louisiana,
W84-00896 2A

LEITIS, E.
Chemistry and Application of Ozone and Ozone/UV Light for Water Reuse-II,
W84-00962 5D

LEITMAN, H. M.
Wetland Hydrology and Tree Distribution of the Apalachicola River Flood Plain, Florida,
W84-00813 2I

LEONARD, W. C.
Hydrogeochemical Cycling in a Watershed-Groundwater System: Fort River and Cadwell Creek, Massachusetts,
W84-00967 5B

LEONE, H. L. JR.
Water Quality of the Upper Vermilion River, Louisiana, April-August 1980,
W84-01046 5B

LEROUX, E. F.
Water-Resources Investigations of the U.S. Geological Survey in South Dakota,
W84-00827 7A

LESTER, W. C.
Development of Environmental Standards for Combined Desalination/Power Generating Stations in the Arabian Gulf Region,
W84-00744 3A

LEVINGS, G. W.
Potentiometric-Surface Map of Water in the Eagle Sandstone and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00949 7C

Potentiometric-Surface Map of Water in the Fox Hills Lower Hell Creek Aquifer in the Northern Great Plains are of Montana,
W84-00903 7C

Potentiometric-Surface Map of Water in the Judith River Formation in the Northern Great Plains Area of Montana,
W84-00877 7C

Potentiometric-Surface Map of Water in the Lakota Formation and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00881 7C

Selective Annotated Bibliography of Ground-Water Resources, Records of Wells and Springs, and Availability of Streamflow Data on Indian Reservations in Montana,
W84-00863 7C

LEVINGS, J. F.
Hydrogeology and Simulation Model of Water Flow in the Kootenai Aquifer of the Judith Basin, Central Montana,
W84-01009 2F

LEWIS, J. D.
Monthly Low-Flow Characteristics of Georgia Streams,
W84-00923 7C

LIBERT, J. J.
Desalination and Renewable Energies - A Few Recent Developments,
W84-00755 3A

LICHTER, J. C.
Removal of Refractory Organics from Water by Aeration. II. Solvent Sublation of Methylene Blue and Methyl Orange,
W84-00954 5F

LILLIE, R. A.
Limnological Characteristics of Wisconsin Lakes,
W84-00794 2H

LINDGREN, R. J.
Determination of Irrigation Pumpage in Parts of Kearny and Finney Counties, Southwestern Kansas,
W84-00772 6D

LOPEZ-LEIVA, M.
Membrane Technology Applied to Bioconversion of Macromolecular Substrates and Upgrading of Products. A Model Study on Ethanol Production from Cellulose,
W84-00709 3A

LOPEZ, M. A.
Magnitude and Frequency of Flooding on Small Urban Watersheds in the Tampa Bay Area, West-Central Florida,
W84-00994 2A

LUMB, A. M.
Procedures for Assessment of Cumulative Impacts of Coal Mining on the Hydrologic Balance,
W84-00780 4C

MAADHAH, A. G.
Performance Study of Water Desalination Methods in Saudi Arabia,
W84-00740 3A

MABROOK, B.
Ground Water Resources in Fayoum Area, Egypt,
W84-00747 3A

Origin of Subsurface Water in Khartoum Province, Sudan,
W84-00748 3A

MAHAUT, M.
Utilization of the New Mineral UF Membranes for Making Semi-hard Cheeses,
W84-00701 3A

MALLEY, N.
Advance in Water Quality Monitoring and the Use of Firefly Luciferine/Luciferase Atp Bioassay,
W84-00769 5D

MANJARREZ, R.
Desalination in Mexico,
W84-00752 3A

MANNIK, E.
Solar Distillation: The Solar-Driven Case,
W84-00726 3A

MARIKOS, M.
Estimated Water Use in Missouri, 1980,
W84-00894 7C

MARIO, F. JR.
Hydrogeology of a Landfill Operation, Pinellas County, Florida,
W84-00996 5B

MARTIN, J. B.
Data on Subsurface Storage of Liquid Waste Near Pensacola, Florida, 1963-1980,
W84-00951 7C

MASON, J. W.
Limnological Characteristics of Wisconsin Lakes,
W84-00794 2H

MATHES, M. V.
Drainage Areas of the Kanawha River Basin,
W84-00948 7C

MATTHERS, E. W.
Chloroform Contamination in Part of the Alluvial Aquifer, Southwest Louisville, Kentucky,
W84-01030 5B

MATTHEWS, S. E.
Ground-Water Data for Georgia, 1981,
W84-00986 7C

MATTIASSON, B.
Membrane Technology Applied to Bioconversion of Macromolecular Substrates and Upgrading of Products. A Model Study on Ethanol Production from Cellulose,
W84-00709 3A

MAUBOIS, J. L.
Utilization of the New Mineral UF Membranes for Making Semi-hard Cheeses,
W84-00701 3A

MAUREL, A.
Desalination and Renewable Energies - A Few Recent Developments,
W84-00755 3A

MAURER, D. K.
Geothermal Resources of the Western Arm of the Black Rock Desert, Northwestern Nevada--Part I, Geology and Geophysics,
W84-01007 2F

MCCALL, E. C. JR.
Transport Modeling of an Agricultural Herbicide, A Laboratory Simulation,
W84-00969 5B

MCCUTCHEON, S. C.
Evaluation of Selected One-Dimensional Stream Water Quality Models with Field Data,
W84-01027 5B

MCFADDEN, K. W.
Ground-Water Data for Georgia, 1981,
W84-00986 7C

MCINTOSH, A. W.
Stream Surveillance and Analysis: Shabakunk Creek and Little Bear Brook Watersheds,
W84-00801 5B

MCKENZIE, D. J.
Water-Quality Reconnaisance of the North Data County Solid-Waste Disposal Facility, Florida,
W84-00874 5B

MCKENZIE, S. W.
Determination of Ultimate Carbonaceous BOD and the Specific Rate Constant (K sub 1),
W84-00805 5A

MCKINLEY, P. W.
Water Resources Data for Puerto Rico, 1981-82,
W84-01044 7C

MCQUILLAN, D. M.
Ground Water Quality in the South of Albuquerque,
W84-00856 5B

MEADE, R. H.
Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming: Part III. River Hydraulics and Sediment Transport, 1980,
W84-00937 7C

Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming, Part IV. Bed Elevations, 1980,
W84-00936 7C

MEANS, J. L.
Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

MENDIA, M.
Conceptual Design Aspects of Reverse Osmosis,
W84-00703 3A

METWALLY, A. M.
Reliability of the Jeddah Seawater RO Desalination Plant Based Upon Operations Experience,
W84-00738 3A

MICHAELS, A. S.
Membrane Technology and Biotechnology,
W84-00707 3A

MILLER, D. E.
Water Information for Northwestern Missouri--A Planning Document,
W84-00810 3B

MILLER, J. A.
Principal Aquifers in Florida,
W84-01004 7C

MILLER, J. E.
Changes in Flood Response of the Red River of the North Basin, North Dakota-Minnesota,
W84-01020 4C

MILLER, J. W. JR.
Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area,
W84-00783 2F

MILLER, L. R.
Status of Ground Water Quality in Logan Township, Gloucester County,
W84-00782 5B

MILLER, R. T.
Appraisal of Water From the Pelican River Sand-Plain Aquifer, West-Central Minnesota,
W84-00988 2F

Hydrologic Data for the Pelican River Sands Aquifer, Western Minnesota,
W84-00947 7C

MILLHAM, C. B.
Integrating Intermittent and Renewable Power Resources into the Hydropower system of the Pacific Northwest,
W84-00958 6A

MILLINGTON, D. S.
Specific Identification of Organic Pollutants in Haw River Water Using Gas Chromatography/Mass Spectrometry,
W84-00959 5A

MINERVINI, M.
Reducing and Monitoring Corrosion in MSF Evaporators in the Change-Over From Acid Treatment to Treatment with Additives,
W84-00753 3A

MINGES, D. R.
Rainfall-Runoff Data From Small Watersheds in Colorado, October 1977 Through September 1980,
W84-00858 7C

MOHN, J.
Wind and Solar Powered Reverse Osmosis Desalination Units-Design, Start Up, Operating Experience-,
W84-00730 3A

MOORE, F. E.
Today's Status of pH Measurement and Control in Desalination Plants,
W84-00718 3A

MOORE, M. A.
Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1982 Water Year,
W84-00891 7C

MOREL-SEYTOUX, H. J.
Mathematical Models of Soil Moisture Profiles Using Two-Phase Flow Theory,
W84-00966 2G

MORRIS, R. M.
Experience in Commissioning Large Desalination Plants in the Middle East,
W84-00742 3A

MOWER, R. W.
Hydrology of the Beryl-Enterprise Area, Escalante Desert, Utah, with Emphasis on Ground Water,
W84-01024 2F

MOYLE, W. R. JR.
Water Resources of Borrego Valley and Vicinity, California, Phase 1--Definition of Geologic and Hydrologic Characteristics of Basin,
W84-00980 7C

MUIR, K. S.
Ground Water in the Seaside Area, Monterrey County, California,
W84-00991 2F

MULHOLLAND, M. T.
Historic and Prehistoric Patterns of Water Use in the Connecticut River Valley: Implications for Water Resources Planning,
W84-00968 6D

MULLER, A.
Wind and Solar Powered Reverse Osmosis Desalination Units-Design, Start Up, Operating Experience-,
W84-00730 3A

MURAYAMA, Y.
Advanced Treatment of Secondary Sewage Effluent by Membrane Process,
W84-00760 5D

Operating Experience on Ro Sea Water Desalination Plant at Chigasaki Laboratory,
W84-00759 3A

MYETTE, C. F.
Baseline Water-Quality Data for Sand-Plain Aquifers in Hubbard, Morrison, Otter Tail, and Wadena Counties, Minnesota,
W84-00882 7C

MYRICK, R. M.
Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming: Part III. River Hydraulics and Sediment Transport, 1980,
W84-00937 7C

Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming, Part IV. Bed Elevations, 1980,
W84-00936 7C

NAKHAMKIN, M.
Optimization of Integrated Cogeneration Power Plant and Desalination Plant Systems for a Range of Power and Water Supply Requirements,
W84-00761 3A

NELSON, L. M.
Streamflow and Sediment Transport in the Quillayute River Basin, Washington,
W84-00920 2J

NICHOLS, W. D.
Ground-Water Resources of Essex County, New Jersey,
W84-00797 2F

NIKETIC-ALEKSIC, G.
Application of Selective Membranes in Grape Juice Stabilization,
W84-00706 3A

NOKES, J. M.
Directory of Member Organizations of the National Water Data Exchange (NAWDEX),
W84-00816 10D

NORBECK, S. W.
Data from the Surface-Water Hydrologic Investigations of the Hay Creek Study Area, Montana, and the West Branch Antelope Creek Study Area, North Dakota, October 1976 through April 1982,
W84-00976 7C

NORDSTROM, P.
Water Resources Resume: State Atlas Sheet No. 23, Parts of Bergen, Morris and Passaic Counties,
W84-00792 7C

NOVITZKI, R. P.
Hydrology of Wisconsin, Wetlands,
W84-00998 2H

O'DONNELL, T. H.
Records of Selected Wells and Lithologic Logs of Test Holes, Hendry County and Adjacent Areas, Florida,
W84-00945 7C

O'LEARY, D. A.
Development of Environmental Standards for Combined Desalination/Power Generating Stations in the Arabian Gulf Region,
W84-00744 3A

OAKSFORD, E. T.
Hydraulic Considerations in Sampling the Unsaturated Zone with Inclined Gravity Lysimeters,
W84-01018 2G

ODONE, G.
A New Idea for Training Operators,
W84-00765 3A

OGASAWARA, H.
Advanced Treatment of Secondary Sewage Effluent by Membrane Process,
W84-00760 5D

OHTA, K.
Operating Experience on Ro Sea Water Desalination Plant at Chigasaki Laboratory,
W84-00759 3A

OLSEN, O.
Membrane Technology in the Pulp and Paper Industry,
W84-00704 3A

PABST, M. E.
January 1982 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W84-00981 7C

Percentage Change in Saturated Thickness of the High Plains Aquifer, West-Central Kansas, 1950 to Average 1980-82,
W84-00821 7C

PACKARD, F. A.
Ground Water-Surface Water Relationships in the Bonaparte Creek Basin, Okanogan County, Washington 1979-80,
W84-01017 2A

PAGE, R. W.
Data for Ground-Water Test Hole near Zamora, Central Valley Aquifer Project, California,
W84-00927 7C

PARLIMAN, D. J.
Compilation of Ground-Water Quality Data for Selected Wells in Elmore, Owyhee, Ada, and Canyon Counties, Idaho, 1945 through 1982,
W84-00834 7C

Reconnaissance of Ground-Water Quality, Eastern Snake River Basin, Idaho,
W84-00974 2F

PARR, A. D.
Transport Modeling of an Agricultural Herbicide, A Laboratory Simulation,
W84-00969 5B

PATMONT, C. R
Lake Phosphorus Loading From Septic Systems by Seasonally Perched Ground Water, Puget Sound Region, Washington,
W84-00883 5B

PATRICK, R.
What is the Condition of Our Surface Water.,
W84-00919 5G

PATTERSON, G. L.
Hydrologic Effects of Storing Liquified Sewage Sludge on Strip-Mined Land in Fulton County, Illinois,
W84-00977 5E

PAYNE, D. D. JR.
Drainage Areas of the Kanawha River Basin,
W84-00948 7C

PAYNE, G. A.
Quality of Runoff From Small Watersheds in the Twin Cities Metropolitan Area, Minnesota--Hydrologic Data for 1980,
W84-00982 7C

Streamflow and Suspended-Sediment Transport in Garvin Brook, Winona County, Southeastern Minnesota Hydrologic Data for 1982,
W84-00832 2J

PEARST, D. B.
Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey: 1981 Annual Report,
W84-00897 5A

PECK, J. C.
Legal Aspects of Stored Water in Federal Reservoirs in Kansas,
W84-00971 6E

PEPPER, D.
Membrane Life, Capacity and Costs,
W84-00711 3A

PERRY, R. A.
Definitions of Components of the Master Water Data Index Maintained by the National Water Data Exchange,
W84-00778 10A

PETERSEN, G.
Wind and Solar Powered Reverse Osmosis Desalination Units-Design, Start Up, Operating Experience-,
W84-00730 3A

PETERSON, J. C.
Reconnaissance of Stormwater-Runoff Water Quality of the Big Piney Creek Segment of the Cedar-Piney Watershed, Yell County, Arkansas,
W84-00933 5B

PETTIJOHN, R. A.
Geohydrology of the High Plains Aquifer System in Nebraska,
W84-01002 7C

PLOYART, R.
Solar Desalination: Prototype 'Pithon' A Special Solar Multiple-Effect Distiller,
W84-00729 3A

POLAND, J. F.
Land Subsidence in the San Joaquin Valley, California, as of 1980,
W84-00932 4B

POORE, D. M.
Index of Hydrologic Data for Selected Sites in Broward County, Florida, 1939-80,
W84-00943 7C

PRUDIC, D. E.
Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan,
W84-01008 2F

PRYCH, E. A.
Numerical Simulation of Ground-Water Flow in the Lower Satus Creek Basin, Yakima Indian Reservation, Washington,
W84-01010 4B

PUNNETT, R. E.
Localized Destratification at Lake Texoma,
W84-00956 5G

QUILLAN, E. W.
An Evaluation of Idaho Stream-Gaging Networks,
W84-00866 7A

RAGSDALE, J. O.
Ground-Water Levels in Wyoming, 1971 Through Part of 1980,
W84-00950 7C

RANTZ, S. E.
Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge,
W84-01048 7B

Measurement and Computation of Streamflow: Volume 2. Computation of Discharge,
W84-01049 2E

RANZAU, C. E. JR.
Approximate Altitude of Water Levels in Wells in the Chicot and Evangeline Aquifers in the Houston Area, Texas, Spring 1982,
W84-00922 7C

RASMUSSEN, L. A.
Quadratic Spline Subroutine Package,
W84-00993 2A

RAZEM, A. C.
Model Modifications for Simulation of Flow Through Stratified Rocks in Eastern Ohio,
W84-00773 4C

REY, M.
Ocean Thermal Energy and Desalination,
W84-00733 3A

RHODEHAMEL, E. C.
A Hydrologic Analysis of the New Jersey Pine Barrens Region,
W84-00781 2A

RICCIO, R.
Status of Ground Water Quality in Logan Township, Gloucester County,
W84-00782 5B

RICHMOND, S. L.
Harbor Management Strategies for New England,
W84-00907 6B

RILEY, F. S.
Land Subsidence in the San Joaquin Valley, California, as of 1980,
W84-00932 4B

ROBBINS, C. H.
Effects of Urbanization on the Magnitude and Frequency of Floods on Small Streams in Tennessee-Basic Data Report No. 2,
W84-00826 4C

ROBINSON, K. M.
Localized Destratification at Lake Texoma,
W84-00956 5G

ROCK, C. A.
Computer Simulation of Phosphorus Cycling in the Sediment-Water System of Eutrophic Lakes,
W84-00964 2H

ROHLICH, G. A.
Industrial Wastewater,
W84-00917 5G

ROONEY, J. G.
Geology and Ground-Water Resources of Salem County, New Jersey,
W84-00795 2F

ROSENAU, J. C.
Geology and Ground-Water Resources of Salem County, New Jersey,
W84-00795 2F

SAARI, R.
Usability of Low Temperature Waste Heat for Sea Water Desalination,
W84-00732 3A

SABRI, Z. A.
Performance Evaluation of MSF Plants, the Case of Jeddah Plants,
W84-00739 3A

SANDEEN, W. M.
Effects of Ground-Water Development in the North Fort Hood Area, Coryell County, Texas,
W84-01032 2F

SAPIK, D. B.
Preliminary Survey of Ground-Water Resources for Island County, Washington,
W84-00878 2F

SAUER, V. B.
Floods of December 1982 and January 1983 in Central and Southern Mississippi River Basin,
W84-00886 7C

Techniques for Estimating Flood Hydrographs for Ungaged Urban Watersheds,
W84-00940 2E

SAWHNEY, B.
Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport,
W84-00999 5B

SCHAEFER, D. H.
Geothermal Resources of the Western Arm of the Black Rock Desert, Northwestern Nevada--Part I, Geology and Geophysics,
W84-01007 2F

Gravity Survey of Dixie Valley, West-Central Nevada,
W84-01000 2F

SCHAEFER, F. T.
Report of the River Master of the Delaware River for the Period December 1, 1980-November 30, 1981,
W84-01040 3D

SCHINER, G. R.
Potentiometric Surface of the Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida, May 1982,
W84-00819 7C

SEILER, R. L.
Erosion and Sediment Characteristics of the Southeastern Uinta Basin, Utah and Colorado,
W84-01036 2J

SEVEBECK, K. P.
Evaluating the Effectiveness of Promoting Residential Water Conservation through Exhibits,
W84-00963 3D

SHAY, J. M.
Water-Quality Data for the American River Basin, California, February-October 1979,
W84-00938 7C

SHEIKH, B.
Health and Safety Aspects of Irrigation of Raw-Eaten Food Crops with Reused Water,
W84-00767 5D

SHULTERS, M. V.
Water-Quality Assessment of the American River, California,
W84-00828 5B

SHULTZ, R. A.
Drainage Areas of the Kanawha River Basin,
W84-00948 7C

SIEGEL, D. I.
Preliminary Evaluation of the Ground-Water-Flow System in the Twin Cities Metropolitan Area, Minnesota,
W84-00995 2F

SIMONDS, E. P.
Hydrology of the Hamilton Lakes and Vicinity, Polk County, Central Florida,
W84-00905 7C

SKELTON, J.
Estimated Water Use in Missouri, 1980,
W84-00894 7C

Water Information for Northwestern Missouri--A Planning Document,
W84-00810 3B

SKRIVAN, J. A.
Semi-Variogram Estimation and Universal Kriging Program (Computer Program Documentation, User's Manual),
W84-00829 7C

SLACK, L. D.
Water Resources of the Santa Fe River Basin, Florida,
W84-01013 2F

SLAGLE, S. E.
Hydrology of Area 49, Northern Great Plains and Rocky Mountain Coal Provinces, Montana and Wyoming,
W84-01043 2A

SLOTO, R. A.
Effect of Urbanization on the Water Resources of Warminster Township, Bucks County, Pennsylvania,
W84-00774 5B

SMITH, C. J.
Small-Stream Flood Investigations in Minnesota, October 1958 to September 1980,
W84-01033 7C

SMITH, M. M.
Chemistry and Application of Ozone and Ozone/UV Light for Water Reuse-II,
W84-00962 5D

SNIDER, J. L.
Premining Hydrology of the Lignite Area in Southeastern De Soto Parish, Louisiana,
W84-01006 4C

SOHM, J. E.
Estimated Water Use in Southwest Florida, 1981, and Summary of Annual Water Use, 1970, 1975, and 1977-81,
W84-00892 7C

Wetland Hydrology and Tree Distribution of the Apalachicola River Flood Plain, Florida,
W84-00813 2I

SONENSHEIN, R. S.
Index of Hydrologic Data for Selected Sites in Broward County, Florida, 1939-80,
W84-00943 7C

SORENSON, S. K.
Water-Quality Assessment of the Merced River, California,
W84-00924 5B

SPECHLER, R. M.
Appraisal of the Interconnection between the St. Johns River and the Surficial Aquifer, East Central Duval County, Florida,
W84-00975 6G

SPEECHLER, R. M.
Generalized Configuration of the Top of the Limestone Unit of the Lower Part of the Surficial Aquifer, Duval County, Florida,
W84-01037 7C

SPENCER, H. G.
Closed Cycle Textile Dyeing:Full Scale Renovation of Hot Wash Water by Hyperfiltration,
W84-00749 3A

SPINAZOLA, J. M.
Geohydrologic Data from Sandstone Aquifers in Southwestern Kansas,
W84-00864 7C

SPRUILL, T. B.
Statistical Summaries of Selected Chemical Constituents in Kansas Ground-Water Supplies,
W84-00869 2F

STAMER, J. K.
Determination of Ultimate Carbonaceous BOD and the Specific Rate Constant (K sub 1),
W84-00805 5A

STEELE, T. D.
Reservoir-Development Impacts on Surface-Water Quantity and Quality in the Yampa River Basin, Colorado and Wyoming,
W84-01042 4C

STERNER, R.
Activities in Spain,
W84-00757 3A

STOCKMAN, L.
Closing Remarks,
W84-00715 3A

STOKER, Y. E.
Literature Assessment of the Charlotte Harbor Estuarine System and Surrounding Area, Southwest Florida,
W84-00992 10C

STONE, R. B. JR.
Appraisal of the Interconnection between the St. Johns River and the Surficial Aquifer, East Central Duval County, Florida,
W84-00975 6G

STORRS, P. N.
Health and Safety Aspects of Irrigation of Raw-Eaten Food Crops with Reused Water,
W84-00767 5D

STRAUSE, J. L.
Approximate Altitude of Water Levels in Wells in the Chicot and Evangeline Aquifers in the Houston Area, Texas, Spring 1982,
W84-00922 7C

STRICKER, V. A.
Techniques for Estimating Flood Hydrographs for Ungaged Urban Watersheds,
W84-00940 2E

SUMIOKA, S. S.
General Hydrology and External Sources of Nutrients Affecting Pine Lake, King County, Washington,
W84-01015 2H

Ground Water-Surface Water Relationships in the Bonaparte Creek Basin, Okanogan County, Washington 1979-80,
W84-01017 2A

SUPALLA, R. J.
The Economic Value of Ground Water Recharge for Irrigation Use,
W84-00957 4B

SUTCLIFFE, H. JR.
Occurrence and Use of Ground Water in the Venice-Englewood Area, Sarasota and Charlotte Counties, Florida,
W84-00987 6D

SWEILM, F.
Ground Water Resources in Fayoum Area, Egypt,
W84-00747 3A

Origin of Subsurface Water in Khartoum Province, Sudan,
W84-00748 3A

SYLLA, D. A.
Hydrology of Coal-Resource Areas in the Southern Wasatch Plateau, Central Utah,
W84-00893 2A

SYLVESTER, R. E.
Continuous Seismic-Reflection Survey Defining Shallow Sedimentary Layers in the Charlotte Harbor and Venice Areas, Southwest, Florida,
W84-00929 2F

TAGUE, D. F.
Point Source Waste Load Allocation for the Town of Red River,
W84-00855 5G

TARVER, R.
Problems and Issues Related to Managing Water Supply and Water Quality Between North Carolina and Virginia,
W84-00961 6E

THEOBALD, S. M.
Selected Hydrologic Data, 1978-80, Price River Basin, Utah,
W84-00825 7C

THIEL, P. A.
A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River,
W84-00909 5C

THOMAS, J. M.
Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan,
W84-01008 2F

THOMAS, N.
Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey: 1981 Annual Report,
W84-00897 5A

THOMPSON, H.
Chemical Quality of Water in the Upper Part of the Floridian Aquifer, Duval County, Florida,
W84-00806 7C

THOMPSON, T. H.
Occurrence and Use of Ground Water in the Venice-Englewood Area, Sarasota and Charlotte Counties, Florida,
W84-00987 6D

THORDARSON, W.
Results of Hydraulic Tests in U.S. Department of Energy's Wells Doe-4, 5, 6, 7, 8 and 9, Salt Valley, Grand County, Utah,
W84-01039 2F

THRASHER, B. H.
Design of a Small Solar-Powered Desalination System,
W84-00725 3A

TIDBALL, R. A.
Waste Heat Powered Reverse Osmosis Plants,
W84-00731 3A

TLEIMAT, B. W.
Test Results from a Solar Boiler for Saline Water Distillation,
W84-00724 3A

TOOLEY, J. E.
Erosion and Sediment Characteristics of the Southeastern Uinta Basin, Utah and Colorado,
W84-01036 2J

TORAK, L. J.
Modifications and Corrections to the Finite Difference Model for Simulation of Three-Dimensional Ground-Water Flow,
W84-00776 2F

TROMMER, J. T.
The Benchmark Farm Program-- A Method for Estimating Irrigation Water Use in Southwest Florida,
W84-00808 7C

TUCCI, P.
Use of a Three-Dimensional Model for the Analysis of the Ground-Water Flow System in Parker Valley, Arizona and California,
W84-00823 2F

TUCKER, R. K.
Groundwater Quality in New Jersey--An Investigation of Toxic Contaminants,
W84-00912 5B

TURNAGE, J. J.
An Assessment of the Market Potential for Small Solar Powered Desalination Plants,
W84-00722 3A

TWENTER, F. R.
Ground Water for Public Supply at Windigo, Isle Royale National Park, Michigan,
W84-00880 2F

TYLER, B.
Control and Instrumentation Experience at Lok on Pai Msf Seawater Desalination Plant,
W84-00720 3A

UCKERMANN, B.
Combined MSF/VTE-Modules for Hybrid Thermal Seawater Desalination Plants,
W84-00756 3A

UNIONE, A. J.
Design of a Small Solar-Powered Desalination System,
W84-00725 3A

VACCARO, J. J.
Evaluation of Water-Quality Characteristics of Part of the Spokane Aquifer, Washington and Idaho, Using a Solute-Transport Digital Model,
W84-01001 2F

VAN ALSTINE, J. L.
Ground Water and Geology of Marquette County, Michigan,
W84-00925 2F

VEENHUIS, J. E.
Rainfall-Runoff Data From Small Watersheds in Colorado, October 1977 Through September 1980,
W84-00858 7C

VELNICH, A. J.
Drainage Areas in New Jersey: Delaware River Basin and Streams Tributary to Delaware Bay,
W84-00904 7C

VENKATSUBRAMANIAN, K.
Biocatalysis by Membrane-Attached Enzymes and Whole Microbial Cells,
W84-00708 3A

WADDELL, K. M.
Selected Hydrologic Data, 1978-80, Price River Basin, Utah,
W84-00825 7C

WALKER, W. R.
Evaluating the Effectiveness of Promoting Residential Water Conservation through Exhibits,
W84-00963 3D

WALLACE, J. C.
A Plan for Hydrologic Investigations of In-Situ Oil Shale Retorting Near Rock Springs, Wyoming,
W84-00873 2F

WALLER, R. M.
Atlas of Eleven Selected Aquifers in New York,
W84-00983 7C

WALTER, W. H.
Pumpage of Water in Louisiana, 1980,
W84-00997 6D

WANDLE, S. JR.
Drainage Divides, Massachusetts--Taunton River Basin and Southeast Coastal Basins,
W84-00868 7C

WANDLE, S. W. JR.
Drainage Divides, Massachusetts--Connecticut River Lowlands and Chicopee River Basin,
W84-00902 7C

Drainage Divides, Massachusetts--Ipswich and Lower Merrimack River Basins and Northeast Coastal Basins,
W84-00833 7C

Drainage Divides, Massachusetts--Nashua and Concord River Basins,
W84-00822 7C

Estimating Peak Discharges of Small Rural Streams in Massachusetts,
W84-00990 2E

WANGSNESS, D. J.
Reconnaissance of Stream Biota and Physical and Chemical Quality from Selected Land Use on Stream Biology in the Coal-Mining Region, Southwestern Indiana, 1979-80,
W84-00876 5B

WARMAN, J. C.
Groundwater Management in the Southeast,
W84-00955 4B

WEBBER, E. E.
Flood of June 13-15, 1981, in the Blanchard River Basin, Northwestern Ohio,
W84-00777 7C

WEIGLE, J. M.
Geohydrology of the Fresh-Water Aquifer System in the Vicinity of Ocean City, Maryland,
W84-01011 2F

WEIR, J. E. JR.
Results of Hydraulic Tests in U.S. Department of Energy's Wells Doe-4, 5, 6, 7, 8 and 9, Salt Valley, Grand County, Utah,
W84-01039 2F

WELCH, A. H.
Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan,
W84-01008 2F

Geothermal Resources of the Western Arm of the Black Rock Desert, Northwestern Nevada--Part I, Geology and Geophysics,
W84-01007 2F

WELDER, G. E.
Long Range Plans for Hydrologic Investigations,
W84-00852 6B

WELL, D. K.
Ground-Water Data from Selected Wells in Alluvial Aquifers, Powder River Basin, Northeastern Wyoming,
W84-00830 7C

WELLS, J. G.
Geologic and Well-Construction Data for the H-10 Borehole Complex Near the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico,
W84-00901 5E

WHIPPLE, W. JR.
Stream Surveillance and Analysis: Shabakunk Creek and Little Bear Brook Watersheds,
W84-00801 5B

WHITAKER, J. C.
Annapolis Points the Way for Fundy,
W84-00972 8A

WHITE, I. M.
The Application of Pelton Type Impulse Turbines for Energy Recovery on Sea Water Reverse Osmosis Systems,
W84-00762 3A

WHITE, M. K.
Selective Annotated Bibliography of Ground-Water Resources, Records of Wells and Springs, and Availability of Streamflow Data on Indian Reservations in Montana,
W84-00863 7C

WHITEMAN, K. J.
Ground Water-Surface Water Relationships in the Bonaparte Creek Basin, Okanogan County, Washington 1979-80,
W84-01017 2A

Preliminary Survey of Ground-Water Resources for Island County, Washington,
W84-00878 2F

WHITFIELD, M. S. JR.
Results of Hydraulic Tests in U.S. Department of Energy's Wells Doe-4, 5, 6, 7, 8 and 9, Salt Valley, Grand County, Utah,
W84-01039 2F

WICHE, G. J.
A Two-Dimensional Finite-Element Model Study of Backwater and Flow Distribution at the I-10 Crossing of the Pearl River Near Slidell, Louisiana,
W84-00896 2A

WIDMER, K.
Geology of the Ground Water Resources of Mercer County,
W84-00799 2F

Water Resources Resume: State Atlas Sheet No. 23, Parts of Bergen, Morris and Passaic Counties,
W84-00792 7C

WILBER, W. G.
Reconnaissance for Determining Effects of Land Use and Surficial Geology on Concentrations of Selected Elements on Streambed Materials from the Coal Mining, Region, Southwestern Indiana, October 1979 to March 1980,
W84-00771 5B

WILLIAMS, O. O.
Definitions of Components of the Master Water Data Index Maintained by the National Water Data Exchange,
W84-00778 10A

WILLOCKS, G.
Virgin Islands Water and Power Authority (VIWAPA) Horizontal Tube, Falling Film, Low Temperature 1.25 MGD Multi-Effect Distillation Dual Purpose Plant,
W84-00750 3A

WILSON, D. B.
Removing Uranium From Drinking Water Supplies: Demonstration of Selected Ion Exchange and Chemical Clarification,
W84-00857 5F

WILSON, D. J.
Removal of Refractory Organics from Water by Aeration. II. Solvent Sublation of Methylene Blue and Methyl Orange,
W84-00954 5F

WILSON, J.
Ground Water: A Non-Technical Guide,
W84-00915 2F

WINTER, T. C.
General Hydrology and External Sources of Nutrients Affecting Pine Lake, King County, Washington,
W84-01015 2H

WINTERSTEIN, T. A.
Annotated Report and Data Inventory for the Mississippi River Quality-Assessment, Minneapolis-St. Paul Metropolitan Area,
W84-00860 10C

WOJCIK, C. K.
Performance Study of Water Desalination Methods in Saudi Arabia,
W84-00740 3A

WOLANSKY, R. M.
Continuous Seismic-Reflection Survey Defining Shallow Sedimentary Layers in the Charlotte Harbor and Venice Areas, Southwest, Florida,
W84-00929 2F

WOLLITZ, L. E.
Results of Hydraulic Tests in U.S. Department of Energy's Wells Doe-4, 5, 6, 7, 8 and 9, Salt Valley, Grand County, Utah,
W84-01039 2F

WOLMAN, M. G.
Nonpoint Sources,
W84-00916 6B

WOMACK, J. L.
Removal of Refractory Organics from Water by Aeration. II. Solvent Sublation of Methylene Blue and Methyl Orange,
W84-00954 5F

WOODCOCK, D. J.
The Application of Pelton Type Impulse Turbines for Energy Recovery on Sea Water Reverse Osmosis Systems,
W84-00762 3A

WOODHAM, W. M.
Magnitude and Frequency of Flooding on Small Urban Watersheds in the Tampa Bay Area, West-Central Florida,
W84-00994 2A

WOODWARD, J. C.
Water Quality of the Tidal River and Estuary; Hydrologic Data Report, 1981 Water Year with a Section on Chlorophyll-A: Collection and Analysis,
W84-00906 7C

YANAGI, C.
Advanced Treatment of Secondary Sewage Effluent by Membrane Process,
W84-00760 5D

YOUNG, H. W.
Hydrographs of Water Levels in Observation Wells in Idaho, 1971-82,
W84-00831 7C

YURETICH, R. F.
Hydrogeochemical Cycling in a Watershed-Groundwater System: Fort River and Cadwell Creek, Massachusetts,
W84-00967 5B

Hydrogeochemistry of the New Jersey Pine Barrens,
W84-00793 5B

ZABRI, Z. A.
Reliability of the Jeddah Seawater RO Desalination Plant Based Upon Operations Experience,
W84-00738 3A

ZEFF, J. D.
Chemistry and Application of Ozone and Ozone/UV Light for Water Reuse-II,
W84-00962 5D

ZIMMERMAN, E. A.
A Plan for Hydrologic Investigations of In-Situ Oil Shale Retorting Near Rock Springs, Wyoming,
W84-00873 2F

ORGANIZATIONAL INDEX

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, PA.
Ground Water: A Non-Technical Guide, W84-00915 2F

What is the Condition of Our Surface Water., W84-00919 5G

ALFA-LAVAL A.B., LUND (SWEDEN).
System Options and Costs in Dairy Ultrafiltration, W84-00712 3A

ALFA-LAVAL A.B., TUMBA (SWEDEN).
Membrane Processes for Water, Pulp and Paper, Food. State of the Art, W84-00702 3A

ALFATEH UNIV., TRIPOLI (LIBYA).
Instrumentation Problems in Libyn Desalination Plants, W84-00719 3A

ALSTHOM-ATLANTIQUE, GRENOBLE (FRANCE). NEYRTEC DIV.
Ocean Thermal Energy and Desalination, W84-00733 3A

AMES-RIDGEFIELD, INC., IA.
Development of a Marine Osmotic Solar Still for a Sea Water Desalination, W84-00736 3A

ANDERSON-NICHOLS AND CO., INC., NEWINGTON, CT.
Report on Review of Water Supply Planning, Recommendations and Strategy for Western Connecticut. W84-00911 6B

BABCOCK AND WILCOX ESPANOLA S.A., MADRID (SPAIN).
Activities in Spain, W84-00757 3A

BATTELLE COLUMBUS DIV., OH.
Hydrogeochemistry of the New Jersey Pine Barrens, W84-00793 5B

BELGRADE UNIV. (YUGOSLAVIA). FACULTY OF AGRICULTURE.
Application of Selective Membranes in Grape Juice Stabilization, W84-00706 3A

BERGERON S.A., PARIS (FRANCE).
Studies, Testing and Development of a Line of Brine Recirculating Pumps for Sea Water Desalination Installations, W84-00754 3A

BINNIE AND PARTNERS, LONDON (ENGLAND).
Control and Instrumentation Experience at Lok on Pai Msf Seawater Desalination Plant, W84-00720 3A

BOGERT (CLINTON) ASSOCIATES, FORT LEE, NJ.
Wanaque South Project Economic Feasibility Study, Executive Summary. W84-00789 6B

BOSQUES DE LA HERRADURA, MEXICO CITY.
Desalination in Mexico, W84-00752 3A

CAIRO UNIV., GIZA (EGYPT). FACULTY OF ENGINEERING.
Heat Transfer and Fluid Flow Characteristics in Flash Desalination Units, W84-00746 3A

CALIFORNIA UNIV., BERKELEY. SEA WATER CONVERSION LAB.
Test Results from a Solar Boiler for Saline Water Distillation, W84-00724 3A

CARRE, INC., SENECA, SC.
Closed Cycle Textile Dyeing:Full Scale Renovation of Hot Wash Water by Hyperfiltration, W84-00749 3A

CATALYTIC, INC., PHILADELPHIA, PA.
Distributed Control Systems for Desalination, W84-00717 3A

CEA CENTRE D'ETUDES NUCLEAIRES DE SACLAY, GIF-SUR-YVETTE (FRANCE).
Solar Desalination: Prototype 'Pithon' A Special Solar Multiple-Effect Distiller, W84-00729 3A

Desalination and Renewable Energies - A Few Recent Developments, W84-00755 3A

CH2M HILL SOUTHEAST, INC., GAINESVILLE, FL.
An Introduction to New Energy Sources for Desalination, W84-00721 3A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Mathematical Models of Soil Moisture Profiles Using Two-Phase Flow Theory, W84-00966 2G

DORTMUND UNIV. (GERMANY, F.R.).
Combined MSF/VTE-Modules for Hybrid Thermal Seawater Desalination Plants, W84-00756 3A

ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE (SWITZERLAND).
Design and Operation Experience with Solar Powered Multistage Desalination Plants, W84-00728 3A

ENGINEERING-SCIENCE, INC., BERKELEY, CA.
Health and Safety Aspects of Irrigation of Raw-Eaten Food Crops with Reused Water, W84-00767 5D

ENVIROGENICS SYSTEMS CO., EL MONTE, CA.
Waste Heat Powered Reverse Osmosis Plants, W84-00731 3A

ENVIROGENICS SYSTEMS EUROPE, LEIDEN (NETHERLANDS).
Conceptual Design Aspects of Reverse Osmosis, W84-00703 3A

FAIRLEIGH DICKINSON UNIV., TEANECK, NJ.
Proceedings of the International Congress on Desalination and Water Reuse, Manama, Bahrain, Nov. 29-Dec. 3, 1981, W84-00716 3A

The Caribbean, the other Area of Concentration of Desalination Plants, W84-00751 3A

Education and Training in Desalination Around the World, W84-00764 3A

FLORIDA INST. OF TECH., MELBOURNE.
Design of a Small Solar-Powered Desalination System, W84-00725 3A

FOXBORO CO., MA.
Today's Status of pH Measurement and Control in Desalination Plants, W84-00718 3A

GEOLOGICAL SURVEY, ALBANY, NY. WATER RESOURCES DIV.
Atlas of Eleven Selected Aquifers in New York, W84-00983 7C

Hydrology of Wisconsin, Wetlands, W84-00998 2H

Hydraulic Considerations in Sampling the Unsaturated Zone with Inclined Gravity Lysimeters, W84-01018 2G

GEOLOGICAL SURVEY, ALBUQUERQUE, NM. WATER RESOURCES DIV.
Long Range Plans for Hydrologic Investigations, W84-00852 6B

Annual Water-Resources Review, white Sands Missile Range, New Mexico, 1981, W84-00872 2F

Geologic and Well-Construction Data for the H-10 Borehole Complex Near the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico, W84-00901 5E

GEOLOGICAL SURVEY, ATLANTA, GA. WATER RESOURCES DIV.
Predevelopment Flow in the Tertiary Limestone Aquifer, Southeastern United States: A Regional Analysis From Digital Modeling, W84-00884 2F

Floods of December 1982 and January 1983 in Central and Southern Mississippi River Basin, W84-00886 7C

GEOLOGICAL SURVEY, AUSTIN, TX.
Approximate Altitude of Water Levels in Wells in the Chicot and Evangeline Aquifers in the Houston Area, Texas, Spring 1982, W84-00922 7C

GEOLOGICAL SURVEY, AUSTIN, TX. WATER RESOURCES DIV.
Effects of Ground-Water Development in the North Fort Hood Area, Coryell County, Texas, W84-01032 2F

GEOLOGICAL SURVEY, BATON ROUGE, LA. WATER RESOURCES DIV.
Water Quality of the Barataria Marsh Unit, Jean Lafitte National Historic Park, Louisiana (April 1981-March 1982), W84-00900 7C

Pumpage of Water in Louisiana, 1980, W84-00997 6D

Premining Hydrology of the Lignite Area in Southeastern De Soto Parish, Louisiana, W84-01006 4C

Hydrology, Water Quality, and Biology of Baptiste Collette Bayou in Relation to the Mississippi River at Venice, Louisiana, W84-01025 5B

Water Quality of the Upper Vermilion River, Louisiana, April-August 1980, W84-01046 5B

GEOLOGICAL SURVEY, BAY SAINT LOUIS, MS. WATER RESOURCES DIV.
A Two-Dimensional Finite-Element Model Study of Backwater and Flow Distribution at the I-10 Crossing of the Pearl River Near Slidell, Louisiana, W84-00896 2A

Evaluation of Selected One-Dimensional Stream Water Quality Models with Field Data, W84-01027 5B

GEOLOGICAL SURVEY, BISMARCK, ND. WATER RESOURCES DIV.

Water-Resources Investigations in North Dakota--Fiscal Year 1983,
W84-00888 9C

Data from the Surface-Water Hydrologic Investigations of the Hay Creek Study Area, Montana, and the West Branch Antelope Creek Study Area, North Dakota, October 1976 through April 1982,
W84-00976 7C

Changes in Flood Response of the Red River of the North Basin, North Dakota-Minnesota,
W84-01020 4C

Evaluation of the Hydrologic System in the New Leipzig Coal Area, Grant and Hettinger Counties, North Dakota,
W84-01022 2F

Ground-Water Resources of Ransom and Sargent Counties, North Dakota,
W84-01050 2F

GEOLOGICAL SURVEY, BOISE, ID. WATER RESOURCES DIV.

Hydrographs of Water Levels in Observation Wells in Idaho, 1971-82,
W84-00831 7C

Compilation of Ground-Water Quality Data for Selected Wells in Elmore, Owyhee, Ada, and Canyon Counties, Idaho, 1945 through 1982,
W84-00834 7C

Activities in Idaho, Status of Projects, Fiscal Years 1982-83.
W84-00835 9D

An Evaluation of Idaho Stream-Gaging Networks,
W84-00866 7A

Ground-Water Conditions in the Eastern Part of Michaud Flats, Fort Hall Indian Reservation, Idaho,
W84-00879 2F

Reconnaissance of Ground-Water Quality, Eastern Snake River Basin, Idaho,
W84-00974 2F

Gravity Survey of Dixie Valley, West-Central Nevada,
W84-01000 2F

Geothermal Resources of the Western Arm of the Black Rock Desert, Northwestern Nevada--Part I, Geology and Geophysics,
W84-01007 2F

Aquifer Systems in the Great Basin Region of Nevada, Utah, and Adjacent States--A Study Plan,
W84-01008 2F

GEOLOGICAL SURVEY, BOSTON, MA. WATER RESOURCES DIV.

Drainage Divides, Massachusetts--Ipswich and Lower Merrimack River Basins and Northeast Coastal Basins,
W84-00833 7C

Drainage Divides, Massachusetts--Taunton River Basin and Southeast Coastal Basins,
W84-00868 7C

Drainage Divides, Massachusetts--Connecticut River Lowlands and Chicopee River Basin,
W84-00902 7C

Potential Hydrologic Impacts of Ground-Water Withdrawals from the Cape Cod National Seashore, Truro, Massachusetts,
W84-00944 2F

Estimating Peak Discharges of Small Rural Streams in Massachusetts,
W84-00990 2E

Polychlorinated Biphenyls in Housatonic River Sediments in Massachusetts and Connecticut: Determination and Transport,
W84-00999 5B

GEOLOGICAL SURVEY, CHARLESTON, WV. WATER RESOURCES DIV.

Drainage Areas of the Kanawha River Basin,
W84-00948 7C

Water Resources of the Guyandotte River Basin, West Virginia,
W84-00952 7C

GEOLOGICAL SURVEY, CHEYENNE, WY. WATER RESOURCES DIV.

Hydrogeologic Features of the Alluvial Deposits in the Owl Creek Valley, Bighorn Basin, Wyoming,
W84-00770 2F

Ground-Water Data from Selected Wells in Alluvial Aquifers, Powder River Basin, Northeastern Wyoming,
W84-00830 7C

A Plan for Hydrologic Investigations of In-Situ Oil Shale Retorting Near Rock Springs, Wyoming,
W84-00873 2F

Ground-Water Levels in Wyoming, 1971 Through Part of 1980,
W84-00950 7C

GEOLOGICAL SURVEY, COLUMBUS, OH. WATER RESOURCES DIV.

Model Modifications for Simulation of Flow Through Stratified Rocks in Eastern Ohio,
W84-00773 4C

Flood of June 13-15, 1981, in the Blanchard River Basin, Northwestern Ohio,
W84-00777 7C

Microcomputer Computation of Water Quality Discharges,
W84-00985 2J

GEOLOGICAL SURVEY, DENVER, CO. WATER RESOURCES DIV.

Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey: 1981 Annual Report,
W84-00897 5A

Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming, Part IV. Bed Elevations, 1980,
W84-00936 7C

Field Data Describing the Movement and Storage of Sediment in the East Fork River, Wyoming: Part III. River Hydraulics and Sediment Transport, 1980,
W84-00937 7C

Results of Hydraulic Tests in U.S. Department of Energy's Wells Doe-4, 5, 6, 7, 8 and 9, Salt Valley, Grand County, Utah,
W84-01039 2F

GEOLOGICAL SURVEY, DORAVILLE, GA. WATER RESOURCES DIV.

Digital Model Evaluation of the Predevelopment Flow System of the Tertiary Limestone Aquifer, Southeast Georgia, Northeast Florida, and Southern South Carolina,
W84-00779 2F

Monthly Low-Flow Characteristics of Georgia Streams,
W84-00923 7C

Techniques for Estimating Flood Hydrographs for Ungaged Urban Watersheds,
W84-00940 2E

Ground-Water Data for Georgia, 1981,
W84-00986 7C

Hydrogeology of the Providence Aquifer of Southwest Georgia,
W84-01031 2F

GEOLOGICAL SURVEY, HARRISBURG, PA. WATER RESOURCES DIV.

Effect of Urbanization on the Water Resources of Warminster Township, Bucks County, Pennsylvania,
W84-00774 5B

Evaluation of the Stream-flow Data in Pennsylvania,
W84-00809 7A

Water-Quality Assessment of Francis E. Walter Reservoir, Luzerne and Carbon Counties, Pennsylvania,
W84-01029 2H

GEOLOGICAL SURVEY, HELENA, MT. WATER RESOURCES DIV.

Selective Annotated Bibliography of Ground-Water Resources, Records of Wells and Springs, and Availability of Streamflow Data on Indian Reservations in Montana,
W84-00863 7C

Potentiometric-Surface Map of Water in the Judith River Formation in the Northern Great Plains Area of Montana,
W84-00877 7C

Potentiometric-Surface Map of Water in the Lakota Formation and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00881 7C

Potential Effects of Surface Coal Mining on the Hydrology of the Cook Creek Area, Ashland Coal Field, Southeastern Montana,
W84-00899 4C

Potentiometric-Surface Map of Water in the Fox Hills Lower Hell Creek Aquifer in the Northern Great Plains are of Montana,
W84-00903 7C

Potentiometric-Surface Map of Water in the Eagle Sandstone and Equivalent Units in the Northern Great Plains Area of Montana,
W84-00949 7C

Hydrogeology and Simulation Model of Water Flow in the Kootenai Aquifer of the Judith Basin, Central Montana,
W84-01009 2F

Hydrology of Area 49, Northern Great Plains and Rocky Mountain Coal Provinces, Montana and Wyoming,
W84-01043 2A

GEOLOGICAL SURVEY, HURON, SD. WATER RESOURCES DIV.

Water-Resources Investigations of the U.S. Geological Survey in South Dakota,
W84-00827 7A

Major Aquifers in Hanson and Davison Counties, South Dakota,
W84-00978 2F

Major Aquifers in Yankton County, South Dakota,
W84-00979 2F

GEOLOGICAL SURVEY, INDIANAPOLIS, IN. WATER RESOURCES DIV.

Reconnaissance for Determining Effects of Land Use and Surficial Geology on Concentrations of Selected Elements on Streambed Materials from the Coal Mining, Region, Southwestern Indiana, October 1979 to March 1980,
W84-00771 5B

Reconnaissance of Stream Biota and Physical and Chemical Quality from Selected Land Use on Stream Biology in the Coal-Mining Region, Southwestern Indiana, 1979-80,
W84-00876 5B

Ground-Water Resources of the White River Basin, Hamilton and Tipton Counties, Indiana,
W84-00930 2F

Ground-Water Resources of the White River Basin, Delaware County, Indiana, 1977,
W84-00931 2F

GEOLOGICAL SURVEY, JACKSON, MS. WATER RESOURCES DIV.

Water-Level Maps of the Alluvial Aquifer, Northwestern Mississippi September 1981,
W84-00921 7C

Hydrologic Monitoring in the Area of the Proposed Yazoo River Navigation Project, West Central Mississippi, 1978-80,
W84-00942 7C

Quality of Water in Luxapallila Creek at Columbus, Mississippi,
W84-01034 5B

Quality of Water and Time of Travel in Bakers Creek Near Clinton, Mississippi,
W84-01035 5B

GEOLOGICAL SURVEY, LAGUNA NIGUEL, CA. WATER RESOURCES DIV.

Water Resources of Borrego Valley and Vicinity, California, Phase 1--Definition of Geologic and Hydrologic Characteristics of Basin,
W84-00980 7C

GEOLOGICAL SURVEY, LAKEWOOD, CO.

Quality Assurance Practices for the Chemical and Physical Analyses of Water and Fluvial Sediments,
W84-00812 5A

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.

Rainfall-Runoff Data From Small Watersheds in Colorado, October 1977 Through September 1980,
W84-00858 7C

Hydrologic Data for Urban Storm Runoff in the Denver Metropolitan Area, Colorado,
W84-00859 7C

Annual Snowmelt and Rainfall Peak-Flow Data on Selected Foothills Region Streams, South Platte River Arkansas River, and Colorado River Basins, Colorado,
W84-01038 7C

Reservoir-Development Impacts on Surface-Water Quantity and Quality in the Yampa River Basin, Colorado and Wyoming,
W84-01042 4C

GEOLOGICAL SURVEY, LANSING, MI. WATER RESOURCES DIV.

Ground-Water Data for Michigan, 1981,
W84-00875 7C

Ground Water for Public Supply at Windigo, Isle Royale National Park, Michigan,
W84-00880 2F

Ground Water and Geology of Marquette County, Michigan,
W84-00925 2F

Water Quality of Coal Deposits and Abandoned Mines, Saginaw County, Michigan,
W84-00926 7C

GEOLOGICAL SURVEY, LAWRENCE, KS. WATER RESOURCES DIV.

Determination of Irrigation Pumpage in Parts of Kearny and Finney Counties, Southwestern Kansas,
W84-00772 6D

Percentage Change in Saturated Thickness of the High Plains Aquifer, West-Central Kansas, 1950 to Average 1980-82,
W84-00821 7C

Geohydrologic Data from Sandstone Aquifers in Southwestern Kansas,
W84-00864 7C

Statistical Summaries of Selected Chemical Constituents in Kansas Ground-Water Supplies,
W84-00869 2F

January 1982 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W84-00981 7C

Analysis and Computer Simulation of Stream-Aquifer Hydrology, Arkansas River Valley, Southwestern Kansas,
W84-01016 2A

Water-Quality and Fluvial-Sediment Characteristics of Selected Streams in Northeast Kansas,
W84-01045 2J

GEOLOGICAL SURVEY, LINCOLN, NE. WATER RESOURCES DIV.

Geohydrology of the High Plains Aquifer System in Nebraska,
W84-01002 7C

GEOLOGICAL SURVEY, LITTLE ROCK, AR. WATER RESOURCES DIV.

Ground-Water Levels in Arkansas, Spring 1982,
W84-00870 7C

Discharge Data at Water-Quality Monitoring Stations in Arkansas, 1980 Water Year,
W84-00887 7C

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1982 Water Year,
W84-00891 7C

Time of Travel of Selected Arkansas Streams,
W84-00895 2E

Reconnaissance of Stormwater-Runoff Water Quality of the Big Piney Creek Segment of the Cedar-Piney Watershed, Yell County, Arkansas,
W84-00933 5B

Identification and Classification of Perennial Streams of Arkansas,
W84-01041 7C

GEOLOGICAL SURVEY, LOUISVILLE, KY. WATER RESOURCES DIV.

Chloroform Contamination in Part of the Alluvial Aquifer, Southwest Louisville, Kentucky,
W84-01030 5B

GEOLOGICAL SURVEY, MADISON, WI. WATER RESOURCES DIV.

Water Use in Wisconsin, 1979,
W84-00928 7C

Trends in Ground-Water Levels in Wisconsin Through 1981,
W84-01047 7C

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.

Map of the Antelope Valley-East Kern Water Agency Area, California, Showing Ground-Water Subunits and Areas, and Well Hydrographs, 1962 to 1982,
W84-00820 7C

Graphical Method for Estimating Occurrence and Duration of a Critical Low Flow in the Sacramento River at Freeport, California,
W84-00973 5G

Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge,
W84-01048 7B

Measurement and Computation of Streamflow: Volume 2. Computation of Discharge,
W84-01049 2E

GEOLOGICAL SURVEY, MILFORD, PA. WATER RESOURCES DIV.

Report of the River Master of the Delaware River for the Period December 1, 1980-November 30, 1981,
W84-01040 3D

GEOLOGICAL SURVEY, NASHVILLE, TN. WATER RESOURCES DIV.

Effects of Urbanization on the Magnitude and Frequency of Floods on Small Streams in Tennessee-Basic Data Report No. 2,
W84-00826 4C

Cane Creek Flood-Flow Characteristics at State Route 30 Near Spencer, Tennessee,
W84-00871 4C

Results of Pesticide Sampling in Tennessee,
W84-00889 7C

GEOLOGICAL SURVEY, OKLAHOMA CITY, OK. WATER RESOURCES DIV.

Saturated Thickness of the High Plains Regional Aquifer in 1980, Northwestern Oklahoma,
W84-00804 7C

GEOLOGICAL SURVEY, ORLANDO, FL. WATER RESOURCES DIV.

Geohydrology of the Floridan Aquifer in the Withlacoochee River Basin of the Southwest Florida Water Management District,
W84-00984 7C

GEOLOGICAL SURVEY, PHOENIX, AZ. WATER RESOURCES DIV.

Map Showing Groundwater Conditions in the Tonto Basin Area, Gila County, Arizona--1979,
W84-00807 7C

GEOLOGICAL SURVEY, PORTLAND, OR. WATER RESOURCES DIV.

Water-Quality Data for Smith and Bybee Lakes: Portland, Oregon, June to November, 1982,
W84-00890 7C

An Evaluation of Suspended Sediment and Turbidity in Cow Creek, Oregon,
W84-00939 2J

Flood Profiles in the Calapooya Creek Basin, Oregon,
W84-01021 7C

GEOLOGICAL SURVEY, RALEIGH, NC. WATER RESOURCES DIV.

Water Resources Data, North Carolina, Water Year 1982,
W84-01028 7C

GEOLOGICAL SURVEY, RESTON, VA.
Installation and Service Manual for U.S. Geological Survey Manometers,
W84-00811 7B

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.
Modifications and Corrections to the Finite Difference Model for Simulation of Three-Dimensional Ground-Water Flow,
W84-00776 2F

Definitions of Components of the Master Water Data Index Maintained by the National Water Data Exchange,
W84-00778 10A

Procedures for Assessment of Cumulative Impacts of Coal Mining on the Hydrologic Balance,
W84-00780 4C

Directory of Assistance Centers of the National Water Data Exchange (NAWDEX),
W84-00814 10D

Definitions of Components of the Water Data Sources Directory Maintained by the National Water Data Exchange,
W84-00815 10D

Directory of Member Organizations of the Naitonal Water Data Exchange (NAWDEX),
W84-00816 10D

Indentification Codes for Organizations Listed in Computerized Data Systems of the U.S. Geological Survey,
W84-00817 10D

Funding History of the U.S. Geological Survey Federal Data Collection and Analysis Program,
W84-00836 9D

Water Quality of the Potomac River at Chain Bridge at Washington, D.C., Hydrologic Data Report, 1978 Water Year,
W84-00861 7C

Lake Phosphorus Loading From Septic Systems by Seasonally Perched Ground Water, Puget Sound Region, Washington,
W84-00883 5B

Water Quality of the Tidal River and Estuary; Hydrologic Data Report, 1981 Water Year with a Section on Chlorophyll-A: Collection and Analysis,
W84-00906 7C

Geohydrologic Reconnaissance of Lake Mead National Recreation Area--Las Vegas Wash to Opal Mountain, Nevada,
W84-00934 2F

Mineralogy of Fine-Grained Alluvium from Borehole U11g, Expl. 1, Northern Frenchman Flat Area, Nevada Test Site,
W84-00946 2J

GEOLOGICAL SURVEY, ROLLA, MO. WATER RESOURCES DIV.
Water Information for Northwestern Missouri--A Planning Document,
W84-00810 3B

Water-Resources Investigations of the U. S. Geological Survey in Missouri, Fiscal Year 1983,
W84-00862 7C

Estimated Water Use in Missouri, 1980,
W84-00894 7C

GEOLOGICAL SURVEY, SACRAMENTO, CA. WATER RESOURCES DIV.
Water-Quality Assessment of the American River, California,
W84-00828 5B

Water-Quality Assessment of the Merced River, California,
W84-00924 5B

Data for Ground-Water Test Hole near Zamora, Central Valley Aquifer Project, California,
W84-00927 7C

Land Subsidence in the San Joaquin Valley, California, as of 1980,
W84-00932 4B

Water-Quality Data for the American River Basin, California, February-October 1979,
W84-00938 7C

Ground Water in the Seaside Area, Monterrey County, California,
W84-00991 2F

Sediment and Stream-Velocity Data for the Sacramento River Near Hood, California, May 1978 to September 1981,
W84-01003 7C

GEOLOGICAL SURVEY, SALT LAKE CITY, UT. WATER RESOURCES DIV.
Selected Hydrologic Data, 1978-80, Price River Basin, Utah,
W84-00825 7C

Hydrology of Coal-Resource Areas in the Southern Wasatch Plateau, Central Utah,
W84-00893 2A

Hydrology of the Beryl-Enterprise Area, Escalante Desert, Utah, with Emphasis on Ground Water,
W84-01024 2F

Erosion and Sediment Characteristics of the Southeastern Uinta Basin, Utah and Colorado,
W84-01036 2J

GEOLOGICAL SURVEY, SAN JUAN, PR. WATER RESOURCES DIV.
Water Resources Data for Puerto Rico, 1981-82,
W84-01044 7C

GEOLOGICAL SURVEY, ST. PAUL, MN. WATER RESOURCES DIV.
Streamflow and Suspended-Sediment Transport in Garvin Brook, Winona County, Southeastern Minnesota Hydrologic Data for 1982,
W84-00832 2J

Annotated Report and Data Inventory for the Mississippi River Quality-Assessment, Minneapolis-St. Paul Metropolitan Area,
W84-00860 10C

Baseline Water-Quality Data for Sand-Plain Aquifers in Hubbard, Morrison, Otter Tail, and Wadena Counties, Minnesota,
W84-00882 7C

Hydrologic Data for the Pelican River Sands Aquifer, Western Minnesota,
W84-00947 7C

Quality of Runoff From Small Watersheds in the Twin Cities Metropolitan Area, Minnesota--Hydrologic Data for 1980,
W84-00982 7C

Appraisal of Water From the Pelican River Sand-Plain Aquifer, West-Central Minnesota,
W84-00988 2F

Preliminary Evaluation of the Ground-Water-Flow System in the Twin Cities Metropolitan Area, Minnesota,
W84-00995 2F

Small-Stream Flood Investigations in Minnesota, October 1958 to September 1980,
W84-01033 7C

GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.
Semi-Variogram Estimation and Universal Kriging Program (Computer Program Documentation, User's Manual),
W84-00829 7C

Preliminary Survey of Ground-Water Resources for Island County, Washington,
W84-00878 2F

Streamflow and Sediment Transport in the Quillayute River Basin, Washington,
W84-00920 2J

An Engineering Economic Analysis of Artificial Recharge in a Conjunctive Irrigation Plan in the Columbia Basin Project, Washington,
W84-00989 4B

Quadratic Spline Subroutine Package,
W84-00993 2A

Evaluation of Water-Quality Characteristics of Part of the Spokane Aquifer, Washington and Idaho, Using a Solute-Transport Digital Model,
W84-01001 2F

Numerical Simulation of Ground-Water Flow in the Lower Satus Creek Basin, Yakima Indian Reservation, Washington,
W84-01010 4B

Impact of Changes in Land Use on the Ground-Water System in The Sequim-Dungeness Peninsula, Clallam County, Washington,
W84-01014 4C

General Hydrology and External Sources of Nutrients Affecting Pine Lake, King County, Washington,
W84-01015 2H

Ground Water-Surface Water Relationships in the Bonaparte Creek Basin, Okanogan County, Washington 1979-80,
W84-01017 2A

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
Semiannual Water-Level and Potentiometric Contours of Two Water-Yielding Zones in the Surficial Aquifer, 1975-79, Naples, Florida,
W84-00803 7C

Chemical Quality of Water in the Upper Part of the Floridian Aquifer, Duval County, Florida,
W84-00806 7C

The Benchmark Farm Program-- A Method for Estimating Irrigation Water Use in Southwest Florida,
W84-00808 7C

Wetland Hydrology and Tree Distribution of the Apalachicola River Flood Plain, Florida,
W84-00813 2I

Potentiometric Surface of the Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida, May 1982,
W84-00819 7C

Geohydrologic Reconnaissance of Drainage Wells in Florida--An Interim Report,
W84-00865 4B

Ground-Water Levels in Selected Well Fields and in West-Central Florida, May 1982,
W84-00867 7C

Water-Quality Reconnaisance of the North Data County Solid-Waste Disposal Facility, Florida,
W84-00874 5B

Revised Description of Index of Florida Water Data Collection Active Stations and a User's Guide for Station or Site Information Retrieval Computer Program Findex H578,
W84-00885 10D

Estimated Water Use in Southwest Florida, 1981, and Summary of Annual Water Use, 1970, 1975, and 1977-81,
W84-00892 7C

Consumptive Use of Freshwater in Florida, 1980,
W84-00898 7C

Hydrology of the Hamilton Lakes and Vicinity, Polk County, Central Florida,
W84-00905 7C

Continuous Seismic-Reflection Survey Defining Shallow Sedimentary Layers in the Charlotte Harbor and Venice Areas, Southwest, Florida,
W84-00929 2F

Hydrologic Data From Monitoring of Saline-Water Intrusion in the Cape Coral Area, Lee County, Florida,
W84-00935 7C

Index of Hydrologic Data for Selected Sites in Broward County, Florida, 1939-80,
W84-00943 7C

Records of Selected Wells and Lithologic Logs of Test Holes, Hendry County and Adjacent Areas, Florida,
W84-00945 7C

Data on Subsurface Storage of Liquid Waste Near Pensacola, Florida, 1963-1980,
W84-00951 7C

Appraisal of the Interconnection between the St. Johns River and the Surficial Aquifer, East Central Duval County, Florida,
W84-00975 6G

Occurrence and Use of Ground Water in the Venice-Englewood Area, Sarasota and Charlotte Counties, Florida,
W84-00987 6D

Literature Assessment of the Charlotte Harbor Estuarine System and Surrounding Area, Southwest Florida,
W84-00992 10C

Magnitude and Frequency of Flooding on Small Urban Watersheds in the Tampa Bay Area, West-Central Florida,
W84-00994 2A

Hydrogeology of a Landfill Operation, Pinellas County, Florida,
W84-00996 5B

Principal Aquifers in Florida,
W84-01004 7C

Potentiometric Surface of the Floridan Aquifer in Florida, May 1980,
W84-01005 7C

Selected Flow Characteristics of Florida Streams and Canals,
W84-01012 7C

Water Resources of the Santa Fe River Basin, Florida,
W84-01013 2F

Assessment of the Interconnection Between Tampa Bay and the Floridan Aquifer, Florida,
W84-01019 2F

Water Resources of Manatee County Florida,
W84-01026 2F

Generalized Configuration of the Top of the Limestone Unit of the Lower Part of the Surficial Aquifer, Duval County, Florida,
W84-01037 7C

GEOLOGICAL SURVEY, TOWSON, MD. WATER RESOURCES DIV.
Geohydrology of the Fresh-Water Aquifer System in the Vicinity of Ocean City, Maryland,
W84-01011 2F

GEOLOGICAL SURVEY, TRENTON, NJ. WATER RESOURCES DIV.
A Three-Dimensional Ground-Water-Flow Model Modified to Reduce Computer-Memory Requirements and Better Simulate Confining-Bed and Aquifer Pinchouts,
W84-00775 2F

Drainage Areas in New Jersey: Delaware River Basin and Streams Tributary to Delaware Bay,
W84-00904 7C

GEOLOGICAL SURVEY, TUCSON, AZ. WATER RESOURCES DIV.
Use of a Three-Dimensional Model for the Analysis of the Ground-Water Flow System in Parker Valley, Arizona and California,
W84-00823 2F

Annual Summary of Ground-Water Conditions in Arizona, Spring 1981 to Spring 1982,
W84-00824 7C

Floods of November 1978 to March 1979 in Arizona and West-Central New Mexico,
W84-00837 7C

Annual Summary of Ground-Water Conditions in Arizona, Spring 1980 to Spring 1981.
W84-00941 7C

Floods of October 1977 in Southern Arizona and March 1978 in Central Arizona,
W84-00953 2E

Hydrologic Analysis of the Upper San Pedro Basin from the Mexico-United States International Boundary to Fairbank, Arizona,
W84-01023 2A

GEOLOGICAL SURVEY, URBANA, IL. WATER RESOURCES DIV.
Determination of Ultimate Carbonaceous BOD and the Specific Rate Constant (K sub 1),
W84-00805 5A

Proceedings: Illinois Water-Data Users Meeting, Peoria, Illinois, February 23-24, 1982.
W84-00818 7A

Hydrologic Effects of Storing Liquified Sewage Sludge on Strip-Mined Land in Fulton County, Illinois,
W84-00977 5E

GIBBS AND HILL, INC., NEW YORK.
Optimization of Integrated Cogeneration Power Plant and Desalination Plant Systems for a Range of Power and Water Supply Requirements,
W84-00761 3A

GKSS - FORSCHUNGSZENTRUM GEESTHACHT G.M.B.H., GEESTHACHT-TESPERHUDE (GERMANY, F.R.)
Wind and Solar Powered Reverse Osmosis Desalination Units-Design, Start Up, Operating Experience-,
W84-00730 3A

HAYWARD-TYLER PUMP CO., BURLINGTON, VT.
The Application of Pelton Type Impulse Turbines for Energy Recovery on Sea Water Reverse Osmosis Systems,
W84-00762 3A

(HEINZ (H.J.) CO., PITTSBURGH, PA.
Biocatalysis by Membrane-Attached Enzymes and Whole Microbial Cells,
W84-00708 3A

INDIANA STATE BOARD OF HEALTH, INDIANAPOLIS. DIV. OF WATER POLLUTION CONTROL.
Water Quality Monitoring - Rivers and Streams, 1982.
W84-00910 7C

INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, RENNES (FRANCE). DAIRY TECHNOLOGY RESEARCH LAB.
Utilization of the New Mineral UF Membranes for Making Semi-hard Cheeses,
W84-00701 3A

IOWA STATE UNIV., AMES.
Reliability of the Jeddah Seawater RO Desalination Plant Based Upon Operations Experience,
W84-00738 3A

Performance Evaluation of MSF Plants. the Case of Jeddah Plants,
W84-00739 3A

ITALCONSULT, ROME (ITALY).
A Tailored Process for Remineralization and Potabilization of Desalinated Water,
W84-00768 3A

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF GEOGRAPHY AND ENVIRONMENTAL ENGINEERING.
Nonpoint Sources,
W84-00916 6B

KANSAS STATE UNIV., MANHATTAN. DEPT. OF CIVIL ENGINEERING.
Transport Modeling of an Agricultural Herbicide, A Laboratory Simulation,
W84-00969 5B

KANSAS STATE UNIV., MANHATTAN. DEPT. OF SYSTEMATICS AND ECOLOGY.
Site Studies of Determine the Extent and Potential Impact of Herbicide Contamination in Kansas Waters,
W84-00970 5B

KANSAS STATE UNIV., MANHATTAN. SCHOOL OF LAW.
Legal Aspects of Stored Water in Federal Reservoirs in Kansas,
W84-00971 6E

KARA ESTABLISHMENT, JEDDAH (SAUDI ARABIA).
An Assessment of the Market Potential for Small Solar Powered Desalination Plants,
W84-00722 3A

Design of a Commercial Solar-Powered Greenhouse,
W84-00723 3A

KILLMAN (ELSTON T.) ASSOCIATES, INC., MILLBURN, NJ.
Morris County Master Plan: Water Supply Element.
W84-00788 6D

KRAFTWERK UNION A.G., ERLANGEN (GERMANY, F.R.).
An Integrated Self Sufficient Multipurpose Plant for Seawater Desalination,
W84-00763 3A

LOCKHEED MISSILES AND SPACE CO., INC., CARLSBAD, CA.
Development of Environmental Standards for Combined Desalination/Power Generating Stations in the Arabian Gulf Region,
W84-00744 3A

LUND INST. OF TECH. (SWEDEN). DIV. OF CHEMICAL ENGINEERING.
Preconcentration by Reverse Osmosis Before Evaporation - Possibilities in Sweden,
W84-00714 3A

LUND UNIV. (SWEDEN). DEPT. OF BUSINESS ADMINISTRATION.
Membrane Technology and Costs; State of the Art,
W84-00710 3A

LUND UNIV. (SWEDEN). DEPT. OF TECHNICAL MICROBIOLOGY.
Membrane Technology Applied to Bioconversion of Macromolecular Substrates and Upgrading of Products. A Model Study on Ethanol Production from Cellulose,
W84-00709 3A

MAINE UNIV. AT ORONO. DEPT. OF MATHEMATICS.
Computer Simulation of Phosphorus Cycling in the Sediment-Water System of Eutrophic Lakes,
W84-00964 2H

MASSACHUSETTS UNIV., AMHERST. DEPT. OF GEOLOGY AND GEOGRAPHY.
Hydrogeochemical Cycling in a Watershed-Groundwater System: Fort River and Cadwell Creek, Massachusetts,
W84-00967 5B

MERCER COUNTY PLANNING DIV., TRENTON, NJ.
Mercer County Stormwater Toxics Management Project: Delaware and Raritan Canal Conduit Special Study, Trenton, New Jersey.
W84-00802 5B

MIAMI UNIV., CORAL GABLES, FL. LAB. FOR WATER RESEARCH.
Solar Power/Desalination, PV ED System,
W84-00737 3A

NALCO ITALIANA S.P.A., ROME (ITALY).
Reducing and Monitoring Corrosion in MSF Evaporators in the Change-Over From Acid Treatment to Treatment with Additives,
W84-00753 3A

NEBRASKA UNIV.-LINCOLN. DEPT. OF AGRICULTURAL ECONOMICS.
The Economic Value of Ground Water Recharge for Irrigation Use,
W84-00957 4B

NEW ENGLAND RIVER BASINS COMMISSION, BOSTON, MA.
Harbor Management Strategies for New England,
W84-00907 6B

Prospects and Strategies for New England Ports.
W84-00908 6B

Water, Watts, and Wilds: Hydropower and Competing Uses in New England.
W84-00914 6D

NEW JERSEY BUREAU OF GEOLOGY AND TOPOGRAPHY, TRENTON.
Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area,
W84-00783 2F

Water Resources Resume: State Atlas Sheet No. 23, Parts of Bergen, Morris and Passaic Counties,
W84-00792 7C

Geology of the Ground Water Resources of Mercer County,
W84-00799 2F

NEW JERSEY DEPT. OF ENVIRONMENTAL PROTECTION, TRENTON. DIV. OF WATER RESOURCES.
Status of Ground Water Quality in Logan Township, Gloucester County,
W84-00782 5B

NEW JERSEY DEPT. OF ENVIRONMENTAL PROTECTION, TRENTON. OFFICE OF CANCER AND TOXIC SUBSTANCES RESEARCH.
Groundwater Quality in New Jersey--An Investigation of Toxic Contaminants,
W84-00912 5B

NEW MEXICO HEALTH AND ENVIRONMENT DEPT., SANTA FE. ENVIRONMENTAL IMPROVEMENT DIV.
The Puerco River: Muddy Issues Raised by a Mine Water Dominated Ephemeral Stream,
W84-00853 5B

Hydrocarbon Fuels in Ground Water--Increased Awareness and Concern in New Mexico,
W84-00854 5B

Point Source Waste Load Allocation for the Town of Red River,
W84-00855 5G

Ground Water Quality in the South of Albuquerque,
W84-00856 5B

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF CHEMICAL ENGINEERING.
Removing Uranium From Drinking Water Supplies: Demonstration of Selected Ion Exchange and Chemical Clarification,
W84-00857 5F

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF CHEMISTRY
Analysis of Water Samples for Toxic Volatile Organic Compounds: State of the Art Methods and Strategies for Sampling,
W84-00851 5A

NORD-AQUA OY, ESPOO (FINLAND).
Usability of Low Temperature Waste Heat for Sea Water Desalination,
W84-00732 3A

NORTH CAROLINA STATE UNIV. AT RALEIGH.
Groundwater Management in the Southeast,
W84-00955 4B

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF POLITICAL SCIENCE AND PUBLIC ADMINISTRATION.
Problems and Issues Related to Managing Water Supply and Water Quality Between North Carolina and Virginia,
W84-00961 6E

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF SOIL SCIENCE.
Nitrate Loss from Agricultural Drainage Waters: Implications for Nonpoint Source Control,
W84-00965 5B

NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF ENVIRONMENTAL SCIENCES AND ENGINEERING.
Specific Identification of Organic Pollutants in Haw River Water Using Gas Chromatography/Mass Spectrometry,
W84-00959 5A

NORTH CAROLINA UNIV. AT CHAPEL HILL. INST. OF GOVERNMENT.
Interstate Water Law Issues: Unilateral State Legislation, Original Suits in the Supreme Court, Interstate Compacts,
W84-00960 6E

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRICULTURAL ENGINEERING.
Localized Destratification at Lake Texoma,
W84-00956 5G

OSWEGO COUNTY PLANNING BOARD, NY.
A Natural Resource and Land Use Analysis of the Lacona Williamstown Portion of the Tug Hill Aquifer.
W84-00913 2F

PATERSON CANDY INTERNATIONAL LTD., LAVERSTOKE (ENGLAND).
Membrane Life, Capacity and Costs,
W84-00711 3A

PENNSYLVANIA DEPT. OF ENVIRONMENTAL RESOURCES, HARRISBURG. OFFICE OF RESOURCES MANAGEMENT.
The State Water Plan, Subbasin 17, Central Allegheny River.
W84-00784 6D

The State Water Plan, Subbasin 19, Monongahela River.
W84-00785 6D

The State Water Plan, Subbasin 18, Lower Allegheny River.
W84-00786 5B

The State Water Plan, Subbasin 20, Ohio River.
W84-00787 5B

Subbasins 14 and 16, Genesee River and Upper Allegheny River,
W84-00838 6B

Subbasin 11, Upper Juniata River,
W84-00839 6B

Subbasin 15, Lake Erie,
W84-00840 6B

Subbasin 13, Potomac River.
W84-00841 6D

Subbasin 12, Lower Juniata River.
W84-00842 6D

State Water Plan: Subbasin 10, Lower West Branch Susquehanna River.
W84-00843 6B

State Water Plan: Subbasin 9, Central West Branch Susquehanna River.
W84-00844 6B

State Water Plan: Subbasin 8, Upper West Branch Susquehanna River.
W84-00845 5B

State Water Plan: Subbasin 7, Lower Susquehanna River.
W84-00846 6B

State Water Plan: Subbasin 6, Lower Central Susquehanna River.
W84-00847 6D

State Water Plan: Subbasin 5, Upper Central Susquehanna River.
W84-00848 6B

State Water Plan: Subbasin 4, Upper Susquehanna River.
W84-00849 6B

State Water Plan: Subbasin 1, Upper Delaware River.
W84-00850 6B

RIYADH UNIV. (SAUDI ARABIA). COLL. OF ENGINEERING.
Handling of Fuzzy Decisions in the Engineering Management of Large Desalination Plants,
W84-00766 3A

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. WATER RESOURCES RESEARCH INST.
Stream Surveillance and Analysis: Shabakunk Creek and Little Bear Brook Watersheds,
W84-00801 5B

SALINE WATER CONVERSION CORP., RIYADH (SAUDI ARABIA).
The Riyadh Water Transmission System (RWTS),
W84-00743 3A

SCIENCE APPLICATIONS, INC., AMES, IA.
Development of Solar Desal, A Code for Modeling, Simulation and Design of Solar Desalination Systems,
W84-00734 3A

Engineering Design of a 6000 cu m/Day Seawater Hybrid RO-ED Helio-Desalting,
W84-00735 3A

SCIENCE APPLICATIONS, INC., LA JOLLA, CA.
Advance in Water Quality Monitoring and the Use of Firefly Luciferine/Luciferase Atp Bioassay,
W84-00769 5D

STANFORD UNIV., CA.
Membrane Technology and Biotechnology,
W84-00707 3A

SVENSKA TRAEFORSKNINGSINSTITUTET, STOCKHOLM.
Closing Remarks,
W84-00715 3A

SYDNEY UNIV. (AUSTRALIA).
Solar Distillation: The Solar-Driven Case,
W84-00726 3A

Comparison of Solar RO and Solar Thermal Desalination Systems,
W84-00727 3A

Desalination in Australia - Past and Future,
W84-00758 3A

TEXAS UNIV. AT AUSTIN. DEPT. OF ENVIRONMENTAL ENGINEERING.
Industrial Wastewater,
W84-00917 5G

UNIVERSITY OF NORTHERN IOWA, CEDAR FALLS. DEPT. OF SOCIALOGY, ANTHROPOLOGY AND SOCIAL WORK.
Historic and Prehistoric Patterns of Water Use in the Connecticut River Valley: Implications for Water Resources Planning,
W84-00968 6D

UNIVERSITY OF PETROLEUM AND MINERALS, DHAHRAN (SAUDI ARABIA).
Performance Study of Water Desalination Methods in Saudi Arabia,
W84-00740 3A

VANDERBILT UNIV., NASHVILLE, TN. DEPT. OF CHEMISTRY.
Removal of Refractory Organics from Water by Aeration. II. Solvent Sublation of Methylene Blue and Methyl Orange,
W84-00954 5F

VATTENBYGGNADSBYRAN LTD., STOCKHOLM (SWEDEN). DIV. FOR WATER, SOIL AND THE ENVIRONMENT.
Membrane Processes for Water Supply and Reuse - A Question of Energy Consumption and Cost,
W84-00713 3A

VIRGIN ISLANDS WATER AND POWER AUTHORITY, ST. THOMAS.
Virgin Islands Water and Power Authority (VIWAPA) Horizontal Tube, Falling Film, Low Temperature 1.25 MGD Multi-Effect Distillation Dual Purpose Plant,
W84-00750 3A

VIRGINIA WATER RESOURCES RESEARCH CENTER, BLACKSBURG.
Evaluating the Effectiveness of Promoting Residential Water Conservation through Exhibits,
W84-00963 3D

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF COMPUTER SCIENCE.
Integrating Intermittent and Renewable Power Resources into the Hydropower system of the Pacific Northwest,
W84-00958 6A

WATER POLLUTION CONTROL FEDERATION, WASHINGTON, DC.
Municipal Wastewater Treatment: 1970 and Today,
W84-00918 5G

WATER RE-USE PROMOTION CENTER, TOKYO (JAPAN).
Operating Experience on Ro Sea Water Desalination Plant at Chigasaki Laboratory,
W84-00759 3A

Advanced Treatment of Secondary Sewage Effluent by Membrane Process,
W84-00760 5D

WEIR WESTGARTH LTD., GLASGOW (SCOTLAND).
Experience in Commissioning Large Desalination Plants in the Middle East,
W84-00742 3A

WESTGATE RESEARCH CORP., LOS ANGELES, CA.
Chemistry and Application of Ozone and Ozone/UV Light for Water Reuse-II,
W84-00962 5D

WISCONSIN DEPT. OF NATURAL RESOURCES, MADISON.
Limnological Characteristics of Wisconsin Lakes,
W84-00794 2H

A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River,
W84-00909 5C

ZAGAZIG UNIV. (EGYPT).
Ground Water Resources in Fayoum Area, Egypt,
W84-00747 3A

Origin of Subsurface Water in Khartoum Province, Sudan,
W84-00748 3A

ACCESSION NUMBER INDEX

W84-00701 3A
W84-00702 3A
W84-00703 3A
W84-00704 3A
W84-00705 3A
W84-00706 3A
W84-00707 3A
W84-00708 3A
W84-00709 3A
W84-00710 3A
W84-00711 3A
W84-00712 3A
W84-00713 3A
W84-00714 3A
W84-00715 3A
W84-00716 3A
W84-00717 3A
W84-00718 3A
W84-00719 3A
W84-00720 3A
W84-00721 3A
W84-00722 3A
W84-00723 3A
W84-00724 3A
W84-00725 3A
W84-00726 3A
W84-00727 3A
W84-00728 3A
W84-00729 3A
W84-00730 3A
W84-00731 3A
W84-00732 3A
W84-00733 3A
W84-00734 3A
W84-00735 3A
W84-00736 3A
W84-00737 3A
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W84-00739 3A
W84-00740 3A
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W84-00743 3A
W84-00744 3A
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W84-00746 3A
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W84-00749 3A
W84-00750 3A
W84-00751 3A
W84-00752 3A
W84-00753 3A
W84-00754 3A
W84-00755 3A
W84-00756 3A
W84-00757 3A
W84-00758 3A
W84-00759 3A
W84-00760 5D
W84-00761 3A
W84-00762 3A
W84-00763 3A
W84-00764 3A
W84-00765 3A
W84-00766 3A
W84-00767 5D
W84-00768 3A
W84-00769 5D
W84-00770 2F
W84-00771 5B
W84-00772 6D
W84-00773 4C
W84-00774 5B
W84-00775 2F
W84-00776 2F
W84-00777 7C
W84-00778 10A
W84-00779 2F
W84-00780 4C
W84-00781 2A
W84-00782 5B
W84-00783 2F
W84-00784 6D
W84-00785 6D
W84-00786 5B
W84-00787 5B
W84-00788 6D
W84-00789 6B
W84-00790 5B
W84-00791 2F
W84-00792 7C
W84-00793 5B
W84-00794 2H
W84-00795 2F
W84-00796 2F
W84-00797 2F
W84-00798 2F
W84-00799 2F
W84-00800 7C
W84-00801 5B
W84-00802 5B
W84-00803 7C
W84-00804 7C
W84-00805 5A
W84-00806 7C
W84-00807 7C
W84-00808 7C
W84-00809 7A
W84-00810 3B
W84-00811 7B
W84-00812 5A
W84-00813 2I
W84-00814 10D
W84-00815 10D
W84-00816 10D
W84-00817 10D
W84-00818 7A
W84-00819 7C
W84-00820 7C
W84-00821 7C
W84-00822 7C
W84-00823 2F
W84-00824 7C
W84-00825 7C
W84-00826 4C
W84-00827 7A
W84-00828 5B
W84-00829 7C
W84-00830 7C
W84-00831 7C
W84-00832 2J
W84-00833 7C
W84-00834 7C
W84-00835 9D
W84-00836 9D
W84-00837 7C
W84-00838 6B
W84-00839 6B
W84-00840 6B
W84-00841 6D
W84-00842 6D
W84-00843 6B
W84-00844 6B
W84-00845 5B
W84-00846 6B
W84-00847 6D
W84-00848 6B
W84-00849 6B
W84-00850 6B
W84-00851 5A
W84-00852 6B
W84-00853 5B
W84-00854 5B
W84-00855 5G
W84-00856 5B
W84-00857 5F
W84-00858 7C
W84-00859 7C
W84-00860 10C
W84-00861 7C
W84-00862 7C
W84-00863 7C
W84-00864 7C
W84-00865 4B
W84-00866 7A
W84-00867 7C
W84-00868 7C
W84-00869 2F
W84-00870 7C
W84-00871 4C
W84-00872 2F
W84-00873 2F
W84-00874 5B
W84-00875 7C
W84-00876 5B
W84-00877 7C
W84-00878 2F
W84-00879 2F
W84-00880 2F
W84-00881 7C
W84-00882 7C
W84-00883 5B
W84-00884 2F
W84-00885 10D
W84-00886 7C
W84-00887 7C
W84-00888 9C
W84-00889 7C
W84-00890 7C
W84-00891 7C
W84-00892 7C
W84-00893 2A
W84-00894 7C
W84-00895 2E
W84-00896 2A
W84-00897 5A
W84-00898 7C
W84-00899 4C
W84-00900 7C
W84-00901 5E
W84-00902 7C
W84-00903 7C
W84-00904 7C
W84-00905 7C
W84-00906 7C
W84-00907 6B
W84-00908 6B
W84-00909 5C
W84-00910 7C
W84-00911 6B
W84-00912 5B
W84-00913 2F
W84-00914 6D
W84-00915 2F
W84-00916 6B
W84-00917 5G
W84-00918 5G
W84-00919 5G
W84-00920 2J
W84-00921 7C
W84-00922 7C
W84-00923 7C
W84-00924 5B
W84-00925 2F
W84-00926 7C
W84-00927 7C
W84-00928 7C
W84-00929 2F
W84-00930 2F
W84-00931 2F
W84-00932 4B
W84-00933 5B
W84-00934 2F
W84-00935 7C
W84-00936 7C
W84-00937 7C
W84-00938 7C
W84-00939 2J
W84-00940 2E
W84-00941 7C
W84-00942 7C
W84-00943 7C
W84-00944 2F
W84-00945 7C
W84-00946 2J
W84-00947 7C
W84-00948 7C
W84-00949 7C
W84-00950 7C
W84-00951 7C
W84-00952 7C
W84-00953 2E
W84-00954 5F
W84-00955 4B
W84-00956 5G
W84-00957 4B
W84-00958 6A
W84-00959 5A
W84-00960 6E
W84-00961 6E
W84-00962 5D
W84-00963 3D
W84-00964 2H
W84-00965 5B
W84-00966 2G
W84-00967 5B
W84-00968 6D
W84-00969 5B
W84-00970 5B
W84-00971 6E
W84-00972 8A
W84-00973 5G
W84-00974 2F
W84-00975 6G
W84-00976 7C
W84-00977 5E
W84-00978 2F
W84-00979 2F
W84-00980 7C
W84-00981 7C
W84-00982 7C
W84-00983 7C
W84-00984 7C
W84-00985 2J
W84-00986 7C
W84-00987 6D
W84-00988 2F
W84-00989 4B
W84-00990 2E
W84-00991 2F
W84-00992 10C
W84-00993 2A
W84-00994 2A
W84-00995 2F
W84-00996 5B
W84-00997 6D
W84-00998 2H
W84-00999 5B
W84-01000 2F
W84-01001 2F
W84-01002 7C
W84-01003 7C
W84-01004 7C
W84-01005 7C
W84-01006 4C
W84-01007 2F
W84-01008 2F
W84-01009 2F
W84-01010 4B
W84-01011 2F
W84-01012 7C
W84-01013 2F
W84-01014 4C
W84-01015 2H
W84-01016 2A
W84-01017 2A
W84-01018 2G
W84-01019 2F
W84-01020 4C
W84-01021 7C
W84-01022 2F
W84-01023 2A
W84-01024 2F
W84-01025 5B
W84-01026 2F
W84-01027 5B
W84-01028 7C
W84-01029 2H
W84-01030 5B
W84-01031 2F
W84-01032 2F
W84-01033 7C
W84-01034 5B
W84-01035 5B
W84-01036 2J

W84-01037

W84-01037 7C
W84-01038 7C
W84-01039 2F
W84-01040 3D
W84-01041 7C
W84-01042 4C
W84-01043 2A
W84-01044 7C
W84-01045 2J
W84-01046 5B
W84-01047 7C
W84-01048 7B
W84-01049 2E
W84-01050 2F

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSSION NUMBER INDEX

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